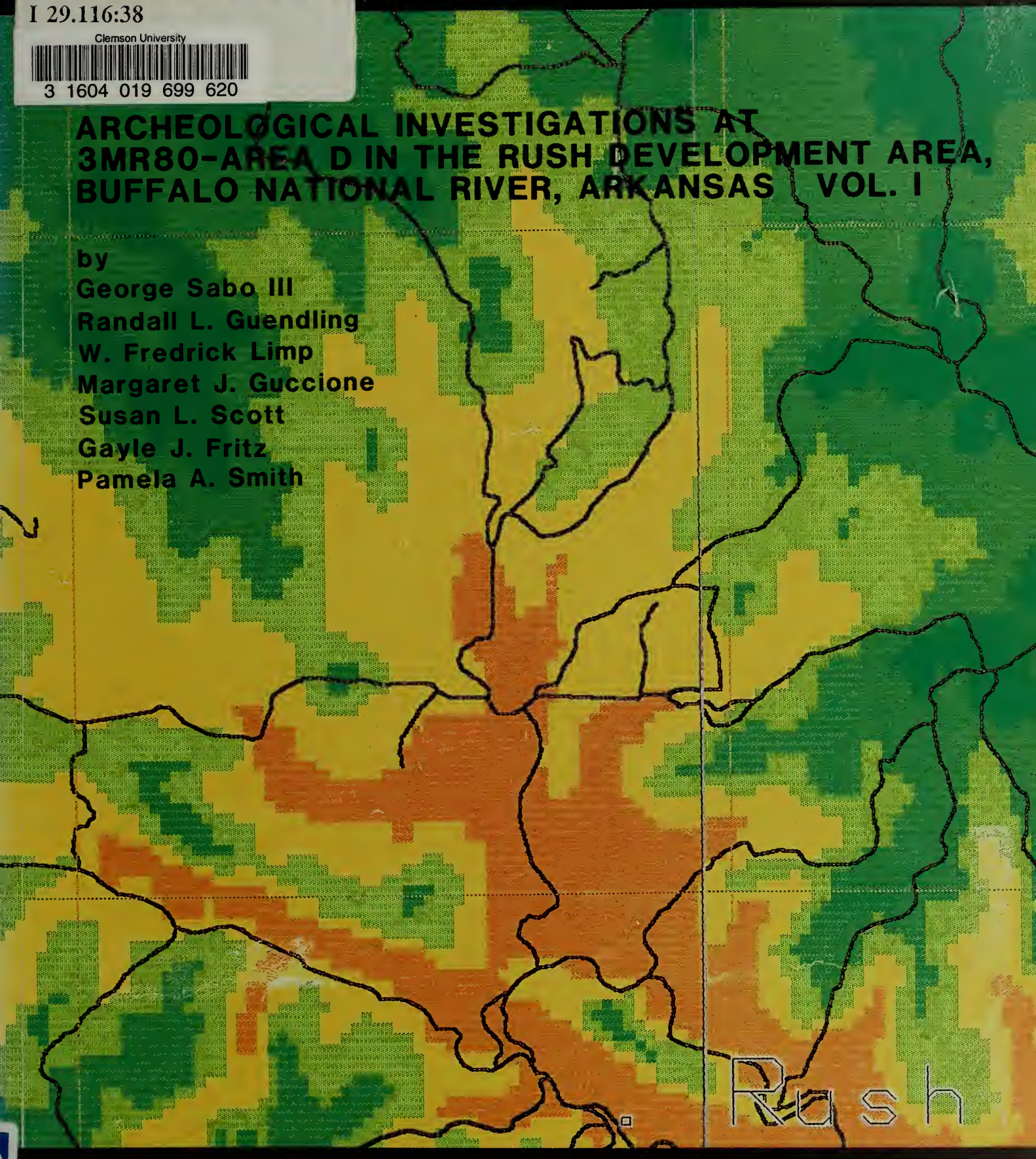
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ARCHEOLOGICAL INVESTIGATIONS AT 3MR80-AREA D IN THE RUSH DEVELOPMENT AREA, BUFFALO NATIONAL RIVER, ARKANSAS VOL. I

by
George Sabo III
Randall L. Guendling
W. Fredrick Limp
Margaret J. Guccione
Susan L. Scott
Gayle J. Fritz
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ABSTRACT

This report documents archeological excavations conducted from October to December, 1988, by the Arkansas Archeological Survey's Sponsored Research Program at 3MR80-Area D, a stratified multicomponent site in the Rush Development Area of the Buffalo National River. This work was performed under a cooperative agreement between the National Park Service, Southwest Region, and the Arkansas Archeological Survey. Planned expansion of the Rush Campground facility necessitated data recovery excavations to mitigate adverse impacts to significant archeological remains identified in a previous examination of the site. Stratified deposits encountered at this site contained cultural materials representing five components: Dalton to Early Archaic, Early to Middle Archaic, Late Archaic, Early Woodland, and Middle Woodland to Early Mississippian. Geomorphological studies were undertaken to place this evidence for successive prehistoric occupation in the context of the changing alluvial landscape of the lower Buffalo River. Specialized studies of lithic and ceramic artifacts, preserved faunal and floral remains, and radiometric assays provided additional information for cultural reconstructions of each component. Additional analyses were undertaken to address questions concerning intrasite temporal trends, intersite relationships in the lower Buffalo River study area, and regional cultural developments of Late Holocene sedentary adaptations. The application of computerized Geographic Information Systems analysis is illustrated in an evaluation of local environmental parameters, a reconstruction of the presettlement forest using data from nineteenth century Government Land Office surveys, and an analysis of aboriginal land use in the lower Buffalo River study area. In view of the unprecedented quality and integrity of the archeological record at 3MR80-Area D and the extraordinary significance of this site, the 1988 excavations were determined not to constitute an adequate mitigation, and it was recommended that additional data recovery excavations be undertaken if certain portions of Area D could not be permanently preserved. Additional recommendations were made for on-site management and protection of significant archeological sites, and for further archeological investigations in the Rush Development Area.

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Dr. Charles Ewen assumed the position of administrator of the Survey's Sponsored Research Program when this project was in its analysis and report preparation phase, and provided support and leadership at a crucial juncture. Report preparation would not have been possible without the assistance of Karen Wagner (final report) and Nina Flannery (draft report) in wordprocessing, preparation of tables, and editing, James Harcourt in the production of computer graphics, Jane Kellett in the production of graphic and photographic illustrations, Corkie Davis in wordprocessing, and Suzanne McCaleb in paste-up.

The draft version of this report was reviewed by Norma Hoffrichter, Dr. Walter Wait, Dr. John Dixon, Dr. James A. Brown, and the staff of the Arkansas Historic Preservation Program, all of whom took the time to carefully and thoroughly review the manuscript. We believe their comments and suggestions have substantially benefited the present version of the report.

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CHAPTER 1

Project Background

RANDALL L. GUENDLING

This report presents the results of archeological investigations by the Arkansas Archeological Survey at the Dirst site, 3MR80, a deeply stratified, multicomponent site located in the Rush Development Area of the Buffalo National River (Figure 1-1). The National Park Service has proposed expanding public use facilities within the Rush Development Area. The Rush Development Area is a 3.6 ha tract of land on the left bank of the Buffalo River that extends from Clabber Creek southwest to south of Rush Creek. Four archeological sites have been recorded within the area (Figure 1-2). In April of 1986, the Spears Professional Environmental and Archeological Research Service (SPEARS), under contract to the National Park Service, tested three of the four sites--3MR52, 3MR157, and 3MR80--to determine their significance (Spears et al. 1986). All three were found to contain significant subsurface deposits and were therefore judged by SPEARS to be eligible for nomination to the National Register of Historic Places. In addition, SPEARS found a possible prehistoric feature (Feature 1) eroding out of the terrace edge near 3MR51, the fourth site in the development area previously recommended for the National Register (Sierzchula 1984).

The National Park Service (NPS) plans to expand existing facilities and construct new camping facilities in the Rush campground area. The Dirst site, 3MR80, is a large site at the confluence of Rush Creek and the Buffalo River that extends across the entire Rush campground. The site has been subdivided into four areas, A through D, and three of the four areas contain significant deposits. New construction was planned only for Area D. In order to mitigate adverse impacts from the proposed construction, the NPS contracted for data recovery excavations with the Arkansas Archeological Survey (AAS). This work was carried out under the terms of a cooperative agreement between NPS and AAS and derived from a scope of work, a written proposal, and negotiations between the two parties (Appendix 1). Archeological excavations were carried out from October 17 to December 1, 1988, at 3MR80-Area D (Figure 1-3) and 3MR51, Feature 1.

This chapter outlines the nature of the cooperative agreement between the AAS and the NPS, provides background information on previous work at 3MR80 and 3MR51, reviews the AAS field program, and provides a brief summary and assessment of the project's results.

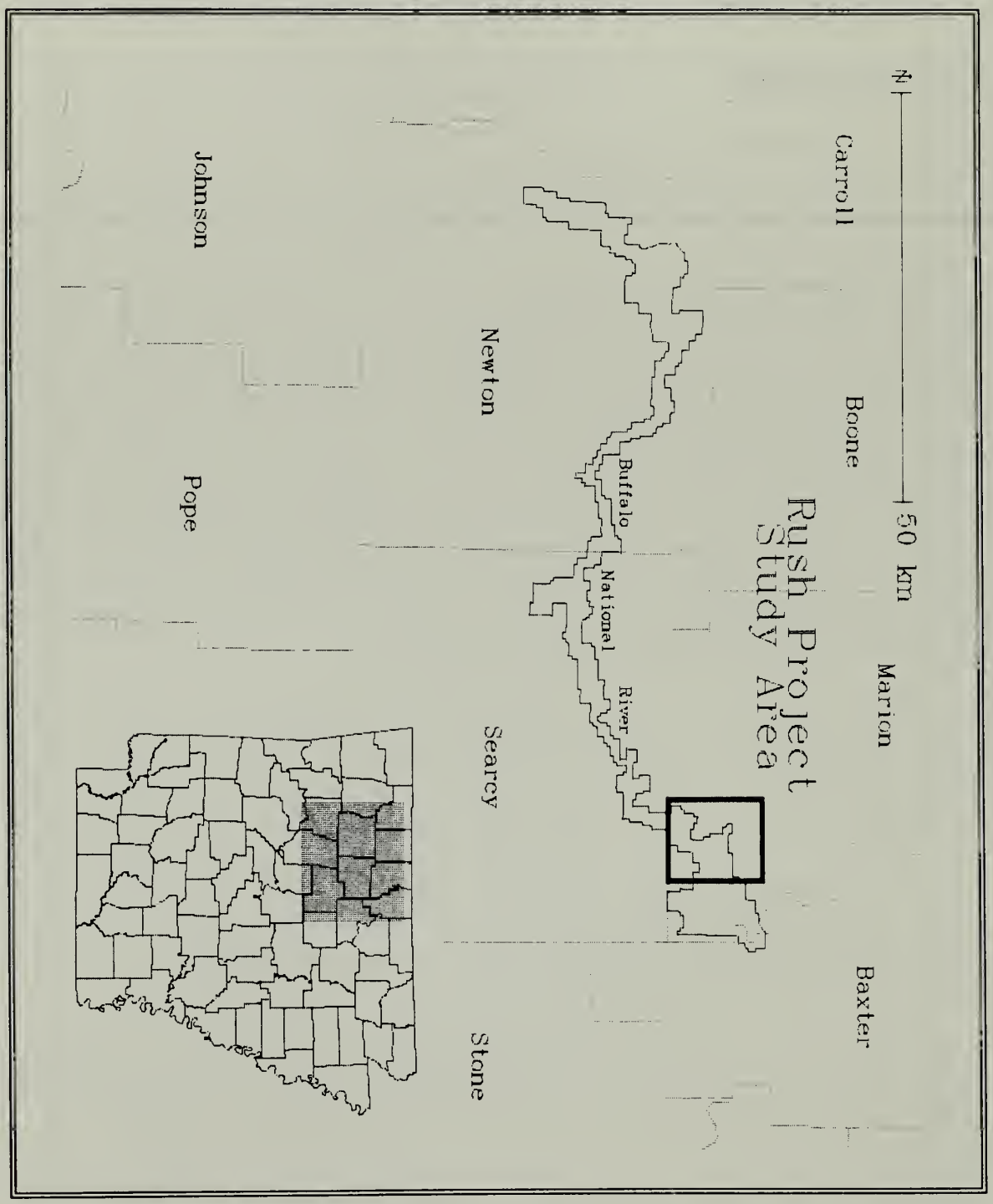


Figure 1-1. Rush project study area, Buffalo National River, Arkansas.

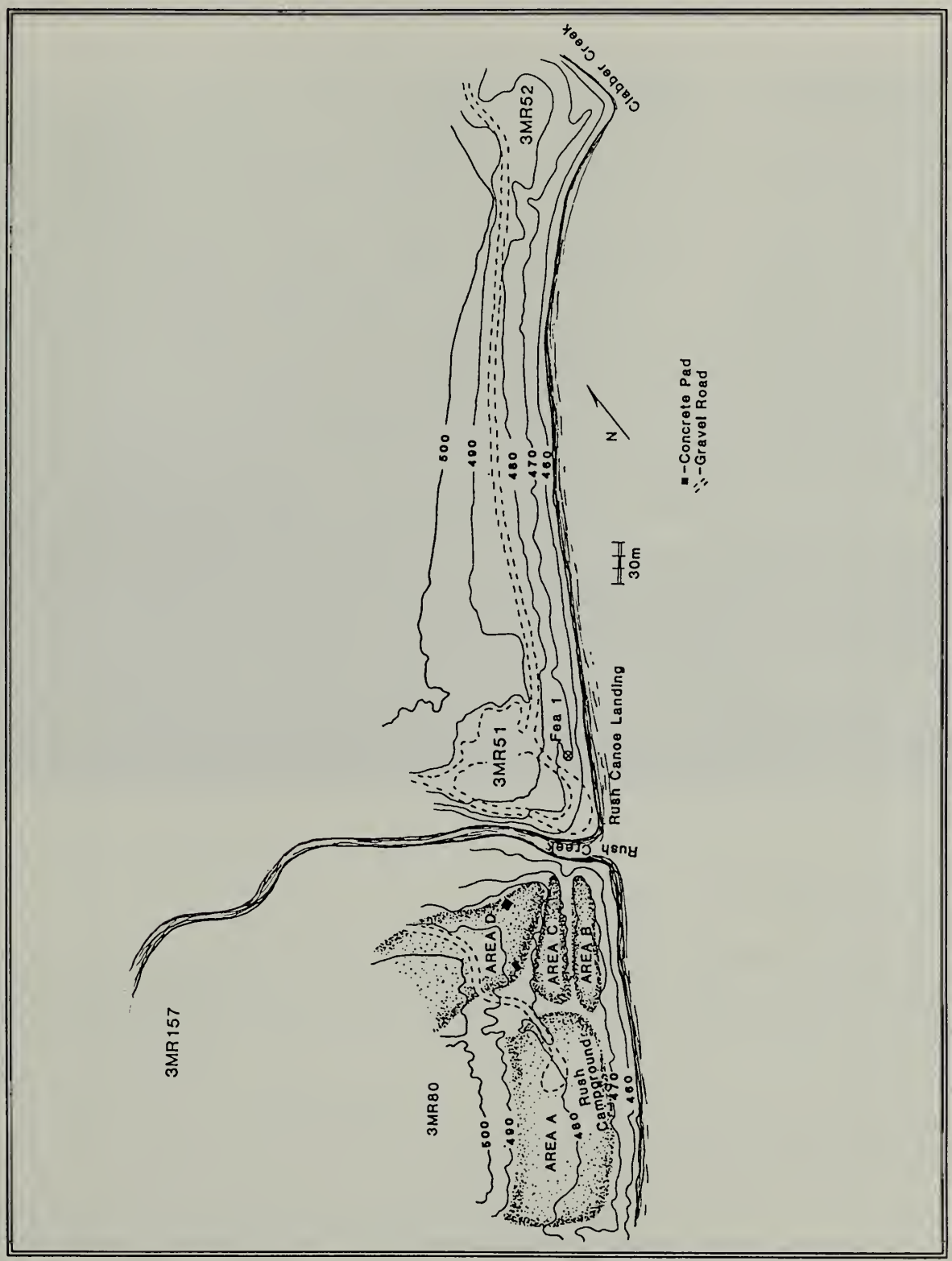


Figure 1-2. Archeological sites in the Rush Development Area.



Figure 1-3. 3MR80-Area D prior to excavation in October, 1988. View to the east (AAS Neg. #885848).

Cooperative Agreement

Acting through the Director of the Southwest Region, the NPS entered into Cooperative Agreement No. CA 7029-8-0007 with the Arkansas Archeological Survey (AAS), University of Arkansas System, in September of 1988 to provide an innovative and comprehensive program of archeological research to be conducted under specific subagreements. Investigations in the Rush Development Area formed the basis of the first subagreement and authorized the work reported here. As part of the cooperative nature of the research, the AAS contributed in three broad areas to the Rush project that extended beyond the scope of work. These areas are personnel time, public outreach, and computer applications.

Personnel. The Arkansas Archeological Survey is charged by law with the study of the archeology of Arkansas, implemented through a system of regionally based scholars. The Principal Investigator for the Rush

project, Dr. George Sabo III, is a Station Archeologist for the AAS whose research concentrates on the study of the Ozark Mountain archeological region. The research potential of the Rush area, and the Dirst site (3MR80) in particular, complements Sabo's other research in the area (Sabo 1986; Sabo et al. 1982; Sabo et al. 1988). A portion of Dr. Sabo's time at the Rush site, and in subsequent analysis and report production, was contributed to the project by the AAS, allowing for greater analytical depth and a synthesis that exceeded the scope of work, directly benefiting both the NPS and the AAS.

Public Outreach. The legislative acts that established the AAS have also mandated its function in public education. The AAS anticipated considerable public interest in the work at the Rush Development Area based on our previous experience with longterm projects. Public interest was accommodated in three ways. First, during the course of the excavations, two designated crew members gave guided tours to approximately 225 visitors. Visitors were given two-page brochures describing the prehistory of the area, the history of the site, and the source of project funding; they were also shown artifacts which were kept at the site for display purposes. Second, project archeologists were available for interviews that appeared in several local and regional newspapers. Third, responding to an invitation from the AAS, the Arkansas Archeological Society volunteered some 602 hours of excavation time to the project. The volunteers from the Society participate in a comprehensive training program that has been jointly sponsored and conducted by the Survey and Society for over twenty years. As a result of these three program elements, the Rush project was a considerable success in public outreach for the NPS.

Computer Applications. The third AAS contribution to the Rush project under the cooperative agreement derives from an ongoing development of and commitment to computer applications in archeological research. The AAS is nationally recognized for its computer facilities and its applications of database management and Geographic Information Systems (GIS). Several specialized computer applications were incorporated into the Rush project.

DELOS, developed by the AAS over the last decade, is a database management system for artifact data that has analytical capabilities as well as an inventory function. The DELOS system was employed in both the preliminary cataloging and analysis phases of the Rush project. Although the DELOS system has finer discriminations than the cataloging functions of the NPS Automated National Cataloging System (ANCS), the two systems are compatible. In a separate subagreement, AAS is writing software to convert DELOS data into an ANCS format for required federal forms. A pilot DELOS-to-ANCS conversion was performed using the Rush project artifact catalog.

Also undertaken as a contribution to this project were the GIS studies reported here that reconstruct the presettlement environmental baseline in the Rush study area and provide various analyses of prehistoric land use. These applications facilitate the cultural ecological orientation of the Rush project research design. Additionally, these applications demonstrate the potential of GIS for meeting longterm management goals involving multiple resources. The creation of GIS map layers for drainage, elevation, roadnet, vegetation, archeological

sites, and other environmental characteristics for the study area provides an inventory and analysis tool that has tremendous potential for future NPS management objectives.

Finally, the advanced word processing and graphic illustration capabilities of the AAS computer facilities were also employed in the production of this final project report.

Of the three contributions by the AAS, the GIS study has the most far-reaching implications for the longterm management of cultural resources within the Buffalo National River. As Frank Schambach has pointed out (1985:ix-x), large federal landholdings often preserve entire settlement systems of archeological sites. In establishing the boundaries of the Buffalo National River, the NPS set off an area large enough to include prehistoric and historic settlement patterns that extended from the upper portion of the Buffalo River to its confluence with the White River. Since the river valley is narrow and surrounded by a rugged landscape, the area was not heavily developed during historic times. Consequently, archeological sites not only are little disturbed (3MR80 for example), but they also remain preserved within their natural settings. It is important that these valuable cultural resources be managed in the broadest sense so that the interrelationships among and between sites and their environmental contexts can be preserved for continuing study and interpretation.

Summary of Previous Investigations in the Rush Development Area

Excavations conducted at 3MR80 and 3MR51 in 1988 by the AAS were preceded by several previous investigations in the Rush Development Area. M. R. Harrington of the Museum of the American Indian (Heye Foundation) in New York visited the area in 1922 during his survey of Ozark rockshelter sites and noted "abundant traces of ancient village sites" on both sides of Rush Creek at its confluence with the Buffalo River (Harrington 1960:139). A brief survey to inventory sites in the Rush locality was conducted in 1979 by Bradford after the Buffalo National River was established (Bradford 1979). Intensive surface examination and testing was undertaken at 3MR51 in 1980 by Sierzchula, who recommended that the site be nominated to the National Register of Historic Places (Sierzchula 1984). Finally, in 1986, extensive testing at four sites in the Rush Development Area--3MR51, 3MR52, 3MR80, and 3MR157--was undertaken by the SPEARS archeological consulting firm (Spears et al. 1986). The following results of the SPEARS investigation are of particular importance to the present project.

3MR80-Area D. Testing at 3MR80-Area D by SPEARS consisted of excavating two backhoe trenches in a terrace on the south side of Rush Creek at the confluence of Rush Creek and the Buffalo River. The terrace ascends about 10 feet above the floodplain and, at the time of testing, the area was described as a "fallow field now covered with secondary growth including high grasses, weeds and poison ivy" (Spears et al. 1986:84).

Backhoe trench profiles in Area D were carefully examined for purposes of geomorphological and archeological interpretation. Backhoe Trench 5 measured 4 m in length and was excavated to a depth of 2.2 m. Four distinct sedimentary units were exposed in the south profile of this trench. The uppermost unit consisted

of 15 to 20 cm of sand interpreted as a deposit associated with the 1982 flooding of the Buffalo River. Below this, and extending to a depth of 75 to 80 cm, was a very dark greyish brown (10YR3/2) silt loam containing abundant charcoal, as well as artifacts and some animal bone. This layer was interpreted as a midden. Diagnostic artifacts consisted of one Late Archaic/Woodland projectile point and one clay tempered pottery sherd. The next layer was a lighter colored (10YR4/4) silt loam extending from approximately 75 cm to 115 cm below the surface and interpreted as a floodplain overbank deposit. It contained fewer artifacts than the overlying midden unit, none temporally diagnostic. The lowest depositional layer, extending from 115 cm to the bottom of the trench, was a silt loam slightly darker in color (10YR4/3) than the overlying unit. This also was interpreted as a floodplain overbank deposit. Although this basal layer contained only five artifacts, one of these was a small metal fragment thought to have been transported downward by root action or rodent activities.

Backhoe Trench 6 measured 4 m in length, and reached a depth of 2 m. Five distinct sedimentary units were identified in the south wall profile. The uppermost layer consisted of a 10 to 12 cm deposit of sand attributed to the 1982 flood. Below this was the midden layer, in this case extending to a depth of 40 cm along the east end of the trench and 30 cm at the west end. In this trench the midden appeared to be slightly darker in color than it was in Backhoe Trench 5. It also contained numerous fragments of mussel shell. A shell and sand tempered pottery sherd was also collected from this layer. A silty loam, interpreted as a floodplain overbank deposit, was identified beneath the midden, extending approximately from 32 cm to 80 cm. This layer contained abundant charcoal and artifacts. Another silt loam sediment extended part way across Backhoe Trench 6 between the unit just mentioned and the lowest layer in the profile. It extended from a depth of 80 cm to 110 cm below the surface, and was interpreted as a floodplain slough infill deposit. The lowest layer exposed in the profile was a thick deposit of silty clay loam exhibiting increasing compactness with depth. Interpreted as a floodplain overbank deposit, this unit contained a large number of artifacts at a fairly consistent depth of 130 cm below the ground surface. Although no paleosol could be identified, it was thought that the line of artifacts across the profile could represent an old ground surface.

In summary, on the basis of the SPEARS investigation, 3MR80-Area D appeared to contain stratified deposits--including a midden zone--in which artifacts were found representing the Mississippi, Woodland, and possibly the Late Archaic periods. It further appeared that intact living surfaces and occupational features, including house remains, were preserved in buried contexts. In addition to artifacts, buried sediments at this site contained charcoal, animal bone, mussel shell, and possibly other indicators of prehistoric lifeways and environments. There was every reason to anticipate the recovery of charcoal in contexts amenable to radiocarbon dating of cultural and/or natural depositional features, and the observation of burned clay fragments on another part of 3MR80 (Spears et al. 1986:69) further suggested the possibility of collecting samples of in situ baked sediments for archeomagnetic dating.

The uniqueness of the Dirst site may be better understood by citing the outcome of intensive survey and testing in northeastern Missouri of a 444 square mile area known as the Cannon Reservoir Project. Several

years of testing resulted in the discovery of only a single deeply stratified, multicomponent site (O'Brien et al. 1982; O'Brien 1986).

In the Arkansas Ozarks, only five stratified, multicomponent sites have been extensively excavated to date. These include the Huntsville and Goforth-Saindon mound sites (Sabo 1986; Kay 1986; Kay, Sabo and Merletti 1989), the Lake Sequoyah site (Stahle 1986), the Mitchell site (Lafferty et al. 1988a), and the recent excavations by Mid-Continental Research Associates at 3NW205 along the Buffalo River near Erbie, Arkansas (Lafferty et al. 1988b). Another multicomponent site along the Illinois River, 3BE332, has been tested and found to be eligible for listing on the National Register of Historic Places (Spears and Lafferty 1985).

Adding to this list similar sites in the Ozark Highland regions of Missouri and Oklahoma (Sabo et al. 1988), the total number of excavated multicomponent stream terrace sites still stands at less than a dozen.

3MR51-Feature 1. During their 1986 investigations in the Rush Development Area, SPEARS also noted a large, burned feature (identified as Feature 1) eroding out of the southern edge of the first terrace on the east side of Rush Creek at its confluence with the Buffalo River, adjacent to the previously recorded site, 3MR51. The burned feature consisted of minimally 5 to 10 cm of fire-reddened clay, extending laterally for at least 1.5 m and at a depth of about 1 m below the present ground surface (Spears et al. 1986:90). Burned limestone slabs and at least one burned and potlidded chert flake were observed to be in direct association with this feature. Feature 1 was interpreted by SPEARS to be located on a segment of 3MR51 artificially detached by construction of a railroad bed during the late nineteenth century.

Intensive surface examination and test excavations were conducted at 3MR51 in 1980 by Sierzchula (1984). At that time the area covered by this site was found to be much more extensive than previously suspected (Bradford 1979), and artifacts were found extending from the ground surface to a maximum depth of 1.75 m. Projectile points collected during this investigation indicated an occupational history extending at least from Early Archaic to the Late Archaic/Woodland periods. Examination of wall profiles exposed in test excavation units and in one backhoe trench revealed no apparent stratification of sediments, however. Sierzchula recommended 3MR51 be nominated to the National Register of Historic Places.

Excavation of Feature 1 was deemed necessary to trace out its full extent, identify any associated cultural remains, and, if possible, determine its relationship to the rest of 3MR51. Successful collection of samples for archeomagnetic dating was anticipated for this feature. Because Early Archaic points were found in the 1984 testing, SPEARS speculated that the apparent depth of the feature could indicate a very early cultural affiliation. Unfortunately, when more fully excavated, the feature was determined to be redeposited and of recent origin.

AAS Excavations

Fieldwork at the Dirst site was conducted in five work sessions between October 17 and December 1, 1988. Work sessions varied from five to seven days and extended across weekends to permit maximum public visitation and to accommodate volunteer participants in the excavations. Although the project was begun in the late fall, we enjoyed good weather most of the time we were in the field. Only a few days were uncomfortably cold, and rain, usually common this time of the year, seriously hampered excavations only once.

Excavations were directed by George Sabo III, and Randall Guendling served as assistant director. The field crew consisted of James Harcourt, Albert Brine, Don Tatum, Keith Smith, and Davis Chenault. The skill and dedication of this crew was largely responsible for the success of this project. In addition to their excavation duties, Harcourt and Brine also shared responsibility as tour guides.

During the archeological fieldwork, a coordinated program of geomorphological investigations was undertaken under the direction of Dr. M. J. Guccione of the University of Arkansas.

Laboratory processing of excavated materials at the AAS central laboratory in Fayetteville was supervised by Debbie Mott Harris. The laboratory crew consisted of Adair Welch, Donna Sheppard, Linda Keely, Pam Stern, Raymond Wooten, Suzanne McCaleb, and Kay Whitman. Volunteers from the Northwest Arkansas Archeological Society also assisted in this work. Laboratory processing and preliminary sorting was completed in the spring of 1989. Specialized analyses by external consultants were initiated during the summer of 1989 and completed by early fall. The draft version of this report was submitted to the NPS on October 27, 1989, twelve and one half months after the initiation of excavations.

Project Results

The 1988 excavations at the Dirst site confirmed the initial observations made by SPEARS in 1986, and provided extensive new data upon which expanded interpretations have been made.

Prehistoric cultural components were identified in a series of stratified alluvial sediments that had been deposited in Area D from Late Pleistocene to Late Holocene times. The deepest stratum exposed (1a) was a Pleistocene age lag gravel deposit, devoid of artifacts, which formed the core of the terrace and lay directly over bedrock. The earliest human occupation identified was in Stratum 1b, an overbank sediment deposited on top of the 1a lag gravel. This stratum contained a paleosol which produced Dalton and Early Archaic period artifacts. Additional Early and Middle Archaic artifacts were found during backhoe trenching in Stratum 2, an overbank sediment representing an early Holocene deposition. The single excavation unit reaching this stratum did not produce any in situ diagnostic artifacts.

Additional Holocene overbank deposits were subdivided into Strata 3 through 5, each of which contained abundant evidence of prehistoric human occupation. In Stratum 3, artifacts dating to the Late Archaic period were found. This occupation evidently was a temporary one, since no features were encountered nor had a midden developed. Stratum 4 produced projectile point types similar to those found in Stratum 3, but the additional presence of thick, grog-tempered pottery sherds argues for an Early Woodland temporal placement for the component identified in this stratum. The enhanced organic content of this stratum and the presence of an arc of postmolds further suggests that this occupation was a more enduring one. The identification of an intact Early Woodland component on an open site is an important first in Ozarks archeology.

Stratum 5 is the thick, dark, artifact rich midden zone identified by SPEARS in 1986. This midden contained abundant cultural debris, including pottery, stone tools, stone debitage, animal bone, mussel shells, snail shells, and carbonized plant remains. The artifact assemblage and associated radiocarbon dates suggest occupation during the Middle Woodland to Early Mississippi periods. Cultural features identified in the midden, including pits, postmolds, and an intact, rock-strewn living surface, provide evidence of permanent habitation. A particularly significant find in the midden zone was a large pit feature containing shell-tempered pottery and domesticated plant remains, including maize, with associated radiocarbon dates falling into the Middle Woodland period. The Stratum 5 midden component at the Dirst site represents an unprecedented discovery for the Ozarks and deals yet another blow to the myth of prehistoric marginality in this region.

Capping Area D was a thin veneer of sands deposited during the 1982 flood. This deposit lay in direct contact with Stratum 5, but the sharpness of the contact between these units suggests that the 1982 flood did not erode much if any of the underlying midden. Similarly, recent use of the site for a canoe livery service does not seem to have seriously impacted the prehistoric cultural deposits at the site. Our excavations indicate that most of the disturbance to near-surface deposits at the site is confined to the area closest to the campground road and is as much the result of natural erosion as recent human activities.

Project Assessment

Excavations at the Dirst site revealed that Area D contains stratified alluvial deposits in which a series of prehistoric occupations has been identified dating from Dalton to Early Mississippian times. Extensive cultural and environmental data concerning this series of occupations have been gathered as a result of the 1988 field work. Analysis and interpretation of these data have provided significant insights concerning prehistoric lifeways in the Rush locality and cultural developments in the central Ozark region. As a result of this project, our understanding of Ozarks prehistory has been substantially advanced.

Management Considerations

In view of the extraordinary importance of the cultural record preserved at the Dirst site, and in consideration of the fact that the integrity of this site will likely be compromised by development and use of Area D as

a campground as well as by natural agencies no matter what precautions are taken, the NPS and the AAS have agreed that further archeological investigations in the Rush Development Area are necessary to satisfactorily mitigate anticipated adverse impacts. Consequently, a second phase of investigation was approved, which permitted further scientific research as well as the development of a comprehensive archeological management plan for the entire Rush Development Area. The scientific and management results of the second phase of the Rush project are addressed in separate volumes.

CHAPTER 2

The Rush Project:

Ozark Prehistory and Research Objectives

GEORGE SABO III

Prehistoric Cultures and Human Adaptations in the Ozarks

Contemporary syntheses of Ozark prehistory (e.g., Purrington 1970; Chapman 1975, 1980; Brown 1984a; Bell 1984a; Sabo et al. 1988) are generally concordant in their attempts to summarize a developmental sequence of archeological complexes and phases. In broad outline, these syntheses employ the terminology for eastern North American prehistory employed by Griffin (1967). In Griffin's masterful synthesis, the terms Paleo-Indian, Archaic, Woodland, and Mississippian were conceived as broad cultural stages (Willey and Phillips 1958; Willey 1966) demarcating major shifts in prehistoric cultural trajectories. Summarized in the most concise terms possible, the Paleo-Indian stage referred to the earliest, nomadic big-game hunting inhabitants of the continent, while the Archaic stage represented a subsequent era lasting for several millennia during which regionally distinctive foraging lifeways emerged. Next came the Woodland stage marked by the invention of pottery, the initial adoption of domesticated plant foods, and increasing social complexity represented in the emergence of Adena and Hopewell burial ceremonialism and associated material culture. The late prehistoric Mississippian stage represented the flouresence of maize-based agriculture supporting the complex, temple mound building societies encountered in the southeast by sixteenth century Spanish explorers. Griffin's synthesis, which replaced an earlier summarization of artifact traits based on the Midwestern Taxonomic System (McKern 1939), emphasized the reconstruction from archeological data of prehistoric lifeways bounded in time and space. It afforded a thoughtful and parsimonious interpretation of evidence available at the time.

Upon its publication, Griffin's synthesis of prehistory was quickly adopted for most of eastern North America except for the Ozark region. At the time, the Ozarks were regarded by many archeologists as a rugged, isolated zone where Woodland and Mississippian developments never really caught on. Harrington's concept of an Ozark "Bluff-dweller culture," developed on the basis of rockshelter excavations in the 1920s (Harrington 1924, 1960), portrayed a changeless hunting and gathering lifeway persisting for several millennia. Domesticated plant food remains preserved in the desiccated sediments of these rockshelters would seem to belie Harrington's interpretations, but with the presumed absence of mound building and pottery manufacturing traditions in the Ozarks (both of which were false presumptions; see for example Brown 1984a), this evi-

dence for Woodland and Mississippian subsistence economies was inevitably overlooked or else considered inconsequential. The following statement by Willey and Phillips best represents the prevailing wisdom of the time:

> ... the entire Ozark Bluff-dweller culture, notwithstanding the abundant remains of domesticated plants in the later phases, remains essentially on the Archaic stage of development as defined in this study. It is a remarkable fact that the culture of a region so close geographically to the centers of maximum intensity of Formative development in the Mississippi Valley has been so impervious to cultural influences from those centers. This would provide an extremely nice frame for a study of cultural-environmental interaction (Willey and Phillips 1958: 124-125).

Archeological research in the Ozarks during the past two decades has made it increasingly difficult to sustain this "cultural lag" hypothesis. With the recent shattering of the "Ozark marginality myth" (Brown 1984a), it has become possible to evaluate comparatively the prehistory of the Ozarks within the general framework of eastern North American prehistory. This comparative evaluation has not proceeded without difficulty, however. The main source of difficulty now stems from the increasing unwieldiness of the typological framework of Paleo-Indian through Mississippian cultural "stages" in light of accumulating archeological and chronometric data. Developments in plant domestication, pottery technology, and mound construction that once were considered hallmarks of the Woodland stage, for example, are now known to have originated during Archaic times. Similarly, at least a few large temple mound centers have recently been dated to the Woodland era. The belief in a unilineal evolutionary progression towards Mississippian culminations throughout eastern North America has likewise been replaced by an acknowledgement of multilineal trajectories attributable partly to regional paleoenvironmental circumstances and partly to independent cultural variation. In consequence of these revolutions in our empirical knowledge, some changes in the ways we conceptualize eastern North American prehistory have taken hold.

Perhaps the most basic change that has developed is that the terms Paleo-Indian, Archaic, Woodland, and Mississippian are now used as time periods rather than as cultural stages (e.g., Steponaitis 1986). Even this change has not proved to be totally satisfactory, however, and as a result alternative frameworks are being sought to permit more incisive syntheses of eastern North American prehistory. Smith (1986), for example, abandoned cultural periods altogether in favor of a "culture-free" chronological framework within which to compare local and regional trends in prehistoric cultural developments throughout the southeast. Stoltman and Baerreis (1983) portrayed eastern North American prehistory in terms of four broad types of human ecosystems they termed the Pioneering, Foraging, Cultivating, and Agricultural types. Unlike the Paleo-Indian to Mississippian scheme, these ecosystem types were not presumed to represent everywhere an unbroken succession from one to the next. Where the development from one ecosystem type to another was observed, Stoltman and Baerreis's discussion centered on the ecological processes giving rise to these transitions. Stoltman and Baerreis's innovative approach provides certain advantages over the Paleo-Indian to Mississippian

terminology, particularly with respect to the issue of delineating temporal and regional variations in the relationships between prehistoric people and their environments. The full potential of the human ecosystem approach for reconstructing prehistoric cultural developments has yet to be realized, however, and any attempts to apply this approach on the local or regional level will require specification of subtypes representing local or regional variants of the major ecosystem types. One of the benefits we may anticipate from the ecological approach, in any event, is that it will underscore the need for comparative assessments of specific prehistoric human ecosystems. One of our most pressing needs at the present is to evaluate comparatively prehistoric cultural trends in the Ozarks in light of cultural trajectories documented elsewhere in eastern North America.

In a recent cultural resource overview, Sabo et al. (1988) summarized the prehistory of the Ozark region using Fitzhugh's concept of the adaptation type (Fitzhugh 1975). The adaptation type is a generalizing non-temporal construct summarizing interrelationships between human socioeconomic activities and their environmental contexts. Adaptation types can therefore be expressed as schematic representations, or models, of past or present human ecosystems. In contrast to Stoltman and Baerreis's human ecosystem types developed for purposes of broad summarization, Fitzhugh's idea of the adaptation type was developed specifically to facilitate interregional comparative analysis. Additionally, adaptation types can be defined on the basis of specific aspects of cultural-environmental interaction pertaining to the subject(s) of investigation, so that resulting models tend to be more amenable to problem-oriented research. As such, this concept reflects a broad theoretical orientation in anthropology that views human culture as an adaptive system in evolutionary rather than in typological perspective (Keesing 1974; Dunnell 1980; Kirch 1980).

For the study of human prehistory, adaptation type models can be used in several ways. First, these models may be used to highlight similarities and differences in human adaptations to similar environments existing in different regions (whether at the same or during different periods of time). This comparative application is illustrated in Fitzhugh's analysis of circumpolar cultural complexes (Fitzhugh 1975). Alternatively, adaptation type models can be used to compare and contrast human adaptations within a single region as the environment changes through time (e.g., Fitzhugh 1972; Sabo et al. 1988). Finally, adaptation type models can be developed for the purpose of framing specific questions or issues concerning human responses to change in biophysical or sociocultural environments that produce detectable archeological consequences (cf. Gould 1980). This latter application is the one employed in the research design of this project.

A sequence of prehistoric cultural complexes and phases can be reconstructed for the Ozarks from evidence derived from controlled excavations at a limited number of archeological sites containing discrete single or multiple components (Table 2-1). Four adaptation type models additionally have been defined on the basis of these data (see Sabo et al. 1988 for a detailed summary). These models express general similarities in adaptive organization that span temporally or areally distinctive archeological complexes and phases. As such they provide a convenient framework for summarizing the general outlines of Ozark prehistory. The basic elements of each model are identified below with additional comments concerning the degree to which each

Table 2-1. Prehistoric cultural sequence for the Ozarks (after Sabo et al. 1988:34).

Mississippi	300 - 1,100 B.P.*
Woodland	
Late	1,100 - 1,350 B.P.
Middle	1,350 - 1,800 B.P.
Early	1,800 - 2,500 B.P.
Archaic	
Late	2,500 - 5,000 B.P.
Middle	5,000 - 8,000 B.P.
Early	8,000 - 9,500 B.P.
Dalton	9,500 - 10,500 B.P.
Paleo-Indian	10,500 - 12,000 B.P.

* B.P. refers to years before present

adaptation type is represented in the central interior portion of the Ozarks within which the Buffalo National River is located. Central issues requiring further investigation are also identified for each model, and finally a research design for the Rush project is outlined based on this background information.

Prehistoric Adaptation Types in the Ozarks

Hunters of the Pleistocene-Holocene Transition

Subsuming the Paleo-Indian (ca. 12,000-10,500 B.P.) and Dalton (ca. 10,500-9,500 B.P.) cultures, this model summarizes the basic characteristics of hunting and gathering adaptations to the fluctuating ecosystems of the late Pleistocene-early Holocene transition. The main elements of this model, drawing upon evidence from across eastern North America, include small-scale human populations, a hunting and animal resource processing technology represented primarily by a distinctive chipped stone tool and weapon inventory, a subsistence-settlement system incorporating seasonally shifting movements within specifically delimited territories, and a suspected pattern of alternating local group aggregations and dispersals triggered by seasonal changes in resource distributions and perhaps other socioeconomic events. Social mechanisms facilitating rapid information exchange and adjustments in the distributions of local groups across wide areas are hypothesized. The most critical feature of this model, however, is a shift from a focal subsistence economy oriented to the capture of large herd animals (such as mammoth, mastodon, and caribou) to a diffuse subsistence economy combining

hunting of solitary animals (such as deer and elk) with secondary foraging for small game and wild plant species as the latter became increasingly available in expanding deciduous forest habitats. This shift in subsistence organization probably brought about corresponding changes in subsistence technology, in the structure and organization of basic socioeconomic units within these societies, and perhaps in other aspects of social organization, ritual, and land use patterns. At present, we poorly understand the nature and the extent of these changes, and it is primarily to facilitate investigation of these issues that we have developed this model.

Archeological evidence corresponding to this model is infrequently encountered in the Ozarks. Several Paleo-Indian projectile points made of locally derived cherts have been found, but the majority of these artifacts represent isolated surface finds. The distribution of these finds across several physiographic zones and in both open site and rockshelter contexts, however, does suggest a diversified utilization of Ozark landscapes on the part of these early populations. Subsequent Dalton period occupations are somewhat better represented in the archeological record. Buried components have been discovered at several Ozark rockshelter sites, and additional Dalton age components occur at a few sites in stratified contexts within river terrace deposits. Most of our present information on the technology, subsistence, and settlement patterns of this adaptation type in the Ozarks comes from Dalton period components.

Given the general paucity of archeological data representing this adaptation type, considerable significance should be accorded to any newly discovered sites found to contain evidence of occupation during the Pleistocene-Holocene transition. Especially important will be any sites containing intact buried components. Although early cultural materials are known from the Buffalo National River area, no sites of this age have been excavated or studied in detail. To realize the research potential of these sites, it will be necessary to apply state-of-the-art techniques to identify the geomorphological context, to assess taphonomic processes affecting the deposit, and to extract a representative sample of paleoenvironmental and cultural remains. Subsistence products or human skeletal remains preserved at sites dating to this time period would be particularly noteworthy. Technological assemblages derived from stratigraphically discrete components would also be highly significant. As further information accrues on Paleo-Indian and Dalton adaptations in the Ozarks, it is anticipated that separate adaptation type models will be needed to highlight the distinguishing characteristics of the Paleo-Indian and Dalton cultural systems.

Foragers of the Early to Middle Holocene

Subsuming the Early and Middle Archaic periods (ca. 9,500-5,000 B.P.), this model represents the increasingly diversified hunting and gathering adaptations of early and middle Holocene populations to emergent hardwood forest ecosystems. Elements of this model include small-scale populations and localized subsistence-settlement systems involving a seasonal round with associated patterns of population aggregation and dispersal. Characteristic chipped stone, ground stone, and bone and shell artifacts and associated subsistence remains represent a variety of activities including hunting and animal resource processing, wild plant food gathering and processing, heavy woodworking, and riverine resource acquisition and utilization. A distinguish-

ing feature of this model is socioeconomic response to the local effects of middle Holocene climatic changes. Hypsithermal climatic conditions generally were warmer and drier than at present, but the effects of these changing conditions on native plant and animal communities and their host landscapes were not uniformly felt throughout the Ozarks (McMillan and Klippel 1981). This model therefore is intended to provide a framework for the investigation of subregional variations in the prehistoric human ecosystems associated with this era.

A considerable number of sites representing cultural phases dating to the Early to Middle Archaic period have been identified in the Ozarks. However, the majority of these sites occur on the region's western and southern margins. During the 1950s, excavations were conducted at a number of Early to Middle Archaic sites along the upper White River in southwest Missouri (Chapman et al. 1960), but these excavations generally produced little in the way of subsistence remains (primarily because effective recovery techniques had not yet been developed). Consequently, we have only partial information for this adaptation type within the central interior portion of the Ozarks. Therefore, any sites within the Ozarks--and especially within the central interior region--that can provide comparative data from well understood archeological contexts corresponding to the early to middle Holocene era would have a very high research potential. It would be appropriate to employ state-of-the-art techniques at these sites to collect a representative sample of the evidence concerning geomorphological context, taphonomic processes, paleoenvironmental conditions, and prehistoric human activities and their associated cultural contexts.

Semi-Sedentary Cultivators of the Late Holocene

The third adaptation type model portrays Late Archaic and Woodland populations, and possibly some Mississippi period groups, whose lifeways reflect a hunting-gathering-gardening adaptation to Late Holocene hardwood forest ecosystems. Distinctive features of this model include a relative increase in the size of local populations, the addition to the subsistence economy of small-scale plant cultivation along with diversification and intensification of local resource utilization, and the addition to the settlement system of sites inhabited for most if not all of the year by at least some members of the local population. Such habitations are indicated by evidence for the construction of permanent dwellings and by the buildup of midden deposits containing evidence of multi-seasonal occupation. These sites represent only one segment of the overall settlement pattern, however, and other kinds of sites (base camps, hunting/foraging camps, workshop sites, etc.) are represented that were inhabited on a seasonal basis by smaller social units within the local group. Additional features of this model include incipient social ranking systems and institutionalized forms of authority most likely associated with the need to organize labor and to maintain solidarity within the local group, perhaps brought on by the shift from reliance on immediate-return to delayed-return subsistence resources (Woodburn 1980). The development of specialized mechanisms for maintaining ties with neighboring groups and the spacing of local groups according to cultural perceptions of social distance (e.g., Kay 1975) are additional features hypothesized for this adaptation type. The central research issue concerning the development of this adaptation type,

however, is identification of the circumstances attending to and consequences stemming from the suspected adoption of domesticated plant production and semi-sedentary settlement.

Archeological data from a large number of sites representing both open and rockshelter contexts provide abundant evidence for this adaptation type. The majority of these sites, however, have been identified along the western, southern, and eastern margins of the Ozarks where most recent research efforts have been conducted. In contrast to these areas, large gaps of uninvestigated territory occur in the central interior regions, including the Buffalo National River area. Surveys and excavations undertaken in the 1950s along the upper White River in southwest Missouri (Chapman et al. 1960) produced some information concerning this adaptation type, which has been added to by more recent work in the Mark Twain National Forest in southern Missouri (Purrington 1985). A recent synthesis of bioarcheological data from the Ozarks corresponding to the Late Holocene era (Burnett 1989) has revealed interesting differences in the biological adaptations of populations inhabiting upland riverine versus major alluvial valley settings. While these differences are not large, populations associated with upland riverine settings tend to exhibit slightly higher caries rates (indicating an elevated consumption of carbohydrates), more severe forms of infectious lesions, and more pronounced evidence of chronic physical stresses than do populations associated with major alluvial valley settings. These data suggest that the Semi-Sedentary adaptation type may have provided slightly greater advantages to alluvial valley populations. If this were true, then we must also consider the possibility that divergent patterns of cultural change might also have developed in upland and lowland zones.

Since archeological sites representing this adaptation type are known only for certain portions of the Ozarks, any sites which may provide evidence of its occurrence in the poorly known areas would have a high research potential. Sites found to contain paleoenvironmental, archeozoological, paleoethnobotanical, or human biological remains would have the highest research potential of all, and state-of-the-art methods should be employed at these sites to collect a representative sample of these remains and thoroughly document their contextual relationships.

Sedentary Cultivators/Farmers of the Late Holocene

The fourth model for the prehistoric Ozarks corresponds to Mississippi period developments presently documented primarily along the western fringes of the region and in adjacent portions of the Arkansas River Valley surrounding the Spiro site in northeastern Oklahoma. The primary elements of this model include a pronounced emphasis on sedentary settlement as indicated by residential sites with multiple permanent dwellings, extensive middens, and, in some cases, associated cemetery areas. Mound centers containing multiple substructural and burial mounds occur in the major river valleys, and these most likely served as central places used by local groups for important civic and ceremonial activities. At some of these mound centers, evidence of burial rituals accorded to presumably high status deceased members of the local group has been documented. These ritual programs suggest a trajectory of increasing social organizational complexity which may have carried over into patterns of interregional interaction and perhaps other spheres of activity (Brown 1981;

Rogers 1983). Finally, an increased focus on the production of plant foods, including the tropical cultigen maize, is suspected. The preservation of abundant cultigens in certain contexts (mainly rockshelter deposits) along with the widespread occurrence of hoes on Mississippi period sites has led many archeologists to conclude that horticultural economies were well developed among these populations (Fritz 1986; Smith 1989). However, a recent synthesis of associated bioarcheological data (Burnett 1989) does not support this conclusion, and in fact suggests that sedentary populations inhabiting major alluvial valley settings were consuming fewer carbohydrates than were the semi-sedentary residents of upland riverine zones. A recent analysis of plant remains recovered during careful excavations in the Late Woodland to Early Mississippian Copple Mound at the Spiro site suggests a mixed foraging and farming subsistence organization for this adaptation type in which a diverse array of plants producing small starchy and oily seeds was cultivated along with a relatively small amount of maize (Fritz 1989). In some places and during some subsequent eras, the production of maize may have increased. Determination of when and where maize horticulture developed in the Ozarks and its role in local subsistence economies relative to other resources are crucial issues that need to be addressed in future archeological research. The analysis of human skeletal assemblages to directly measure dietary patterns, disease loads, and biophysical stresses will be an indispensable element of this research.

As indicated above, this adaptation type has not been positively identified within the central interior portion of the Ozarks, although evidence suggestive of its development within the Buffalo River Valley has been recently noted in the Boxley Valley (Limp 1989a) and Erbie (Lafferty et al. 1988b) areas. A recent reevaluation of data from the upper and middle portions of the White River Valley in southern Missouri (Vogele 1989) suggests the development of sedentary Late Holocene adaptations there as well, and if this were the case, then it would be surprising indeed if similar developments did not also take place in the Buffalo River Valley. Any sites that could furnish additional information confirming either the presence or absence of sedentary adaptations in this region would therefore be highly significant.

Theoretical Perspective for the Rush Project

The theoretical perspective guiding the development and execution of the Rush project reflects the human ecology approach to archeological investigation outlined by Butzer (1982). For Butzer, the archeological study of past human ecosystems is a multifaceted or interdisciplinary endeavor incorporating geoarcheology (the study and interpretation of sediments and the physical landscape; cf. Gladfelter 1977), archeometry (the use of physical and chemical methods of measurement), archeobotany and zooarcheology (the study of plant and animal remains that reflect subsistence activities and past biotic environments), and spatial analysis of contextual relationships at the micro (site), meso (locality), and macro (regional) levels (see Butzer 1982:xi). To this we would stress the additional importance of bioarcheology, the study of human skeletal remains (see Sabo et al. 1988:171-192 for an extensive discussion). And, parting somewhat with Butzer's sentiments concerning "archeology as archeology" (1982:11-12), we believe that consideration of the role of cultural factors (e.g., social organization, ideology) should be an additional element in attempts to reconstruct and interpret past human ecosystems (cf. Gould 1980).

In summary, our application of the human ecology approach in the Rush project begins with delineation of three major areas of concern:

1) Reconstruction of past cultures (or those parts of past cultural systems represented in the archeological record of the Rush locality);

2) Reconstruction of the paleoenvironmental context of those past cultural systems; and

3) Synchronic and diachronic analysis of specific aspects of cultural and environmental interaction and identification of significant cultural-environmental processes affecting past human ecosystems. For reasons outline above, we furthermore believe that the use of adaptation type models for these analyses provides a useful comparative framework for evaluating the results of the Rush project within a broader, regional perspective.

Research Objectives for the Rush Project

We chose to organize the Rush project partly in relation to several broad research questions. These questions are derived from our attempts over the past few years to evaluate the archeological record of the Ozarks using adaptation type models. The primary research questions include the following:

1) To what extent can we discern variability within each adaptation type model for separate sub-areas of the Ozark region? Specifically, can significant differences in prehistoric adaptations be identified for the eastern, interior, and western subareas of the Ozarks? If so, to what extent can this variability be attributed to local environmental differences? Is there evidence to indicate a role for non-environmental factors?

2) What factors were involved in the transitions from non-sedentary to sedentary settlement adaptations in the Ozarks? As noted in Sabo et al. (1988:193-220), presently available bioarcheological evidence does not support the view that late prehistoric populations were heavily dependent upon maize as a dietary source, despite the abundant and well documented occurrence of maize and other cultigens in Ozark rockshelter contexts (e.g., Fritz 1986).

3) How may we explain differences in biological adaptive efficiency among late prehistoric Ozark populations residing in major river valleys, as compared to populations inhabiting upland zones (Sabo et al. 1988:228-38)? To what extent does variation in subsistence organization account for these differences? Are differences in settlement patterns or other factors involved?

4) The lower reaches of the Buffalo River are adjacent to a stretch of the White River along which Mississippi period sites have produced evidence of cultural relationships with the central Mississippi Valley,

including participation in the Southeastern Ceremonial Complex. Previous research suggests that late prehistoric occupations in the Buffalo River Valley may in fact represent a movement of populations into the Ozarks from the area where the lower White River enters the central Mississippi Valley (Wolfman 1979; Morse and Morse 1983). Will evidence from the Rush Development Area support this hypothesis? If evidence is found to support an interpretation of interregional interaction during the Mississippi period, why has no evidence been found that suggests earlier participation of populations from this locality in interregional networks during the Late Archaic and Woodland eras?

It should be noted that we do not anticipate that this phase of our research at Rush will provide conclusive or even partial answers to these questions. However, in our view these questions represent some of the more important issues that need to be addressed in contemporary archeological research, and contemporary research projects must be designed in ways that will at least furnish new data that are relevant to the eventual resolution of these issues.

In light of previous research conducted in the Rush Development Area (summarized in the preceding chapter), in view of the broad research questions outlined in the immediately preceding paragraphs, and in consideration of the NPS Scope of Work for the Rush Development Area, archeological investigations for this project were undertaken to achieve the following specific objectives.

Environmental Context of the Rush Locality

1) Reconstruct the depositional history of the landforms containing 3MR80 and identify major natural and human modifications to these landforms.

2) Compare the geomorphological context of the 3MR80 with other available data for the Buffalo River and other Ozark stream valley records to assess general relationships between geomorphological processes and preservation of the archeological record.

3) Reconstruct environmental parameters of the Rush locality to facilitate comparative analysis of human adaptations to changing Ozark environments.

Archeological Characteristics of Sites in the Rush Locality

1) Determine for 3MR80-Area D and 3MR51-Feature 1 significant aspects of site structure, content, condition, and quality.

2) Delineate cultural components at both sites in terms of stratigraphic context, age, material assemblages, and any associated archeobotanical, zooarcheological, or human skeletal remains.

3) Reconstruct cultural patterns for each component in terms of representative technologies, activity areas, and functional assessments in terms of subsistence, demography, community pattern, external relationships, and ideology, insofar as the evidence will allow.

Comparative Assessments

1) Intrasite analysis to identify aspects of cultural continuity and change preserved in the archeological records of the investigated sites.

2) Intersite analysis of the lower Buffalo River locality to address questions concerning prehistoric land use and the development of past cultural landscapes through time.

3) Regional assessment to place cultural trends in the Rush locality in the context of region-wide patterns of prehistoric cultural development.

CHAPTER 3

Environmental Parameters of the Rush Locality

W. FREDRICK LIMP

PAMELA A. SMITH

Our evaluation of the Rush site's environment has been developed using a Geographic Information (GIS) approach. A GIS is a suite of computer hardware, software, and data which allows the analysis and display of the complex environmental relationships which characterize any area. We have discussed in length elsewhere the particulars of our system and how we believe such systems can be applied to archeological problems (Limp 1989; Parker et al. 1988; Limp et al. 1989b; Farley et al. 1988) and will not review these issues in detail here. In brief, the approach involves the acquisition of appropriate map based data from a variety of sources, both in digital and map form. For data in map form, a process of digitization is needed to transform the data into digital format. Based on a detailed assessment of the analytical requirements of archeological analyses, a cell-based analysis structure is used[1] for the Rush area, a variety of cell sizes are used. Most of the data were processed in a 30 m cell while some of the distance measures (distances to geologic resources) use a 250 m cell. The GIS used for the analysis is the Geographic Resources Analysis Support System (GRASS), which is the official GIS in use by the National Park Service (M. Nyquist, personal communication). Details of the software are described in Westervelt et al. (1989). The analysis focused on a 13,000 hectare area, the location of which is shown in Figure 3-1, overlain with the Buffalo National River Park boundaries. The study area encompasses a rectangle 12 km north-south and 10 km east-west centered on the Rush site. The various primary and secondary data layers used in the study are described below.

Data Layers

Elevation

Digital data for elevation for the entire Buffalo National River area was obtained as digital elevation models (DEMs) from the USGS National Cartographic Information Center (NCIC) at Rolla, Missouri. In the

1. See Kvamme 1989; Kvamme and Koehler 1989; and Limp et al. 1989 for discussions of the merits of vector versus cell-based analysis in an archeological setting; also note that much of the data is retained in a vector (actually arc-node) form as well as in its cell-based representation.

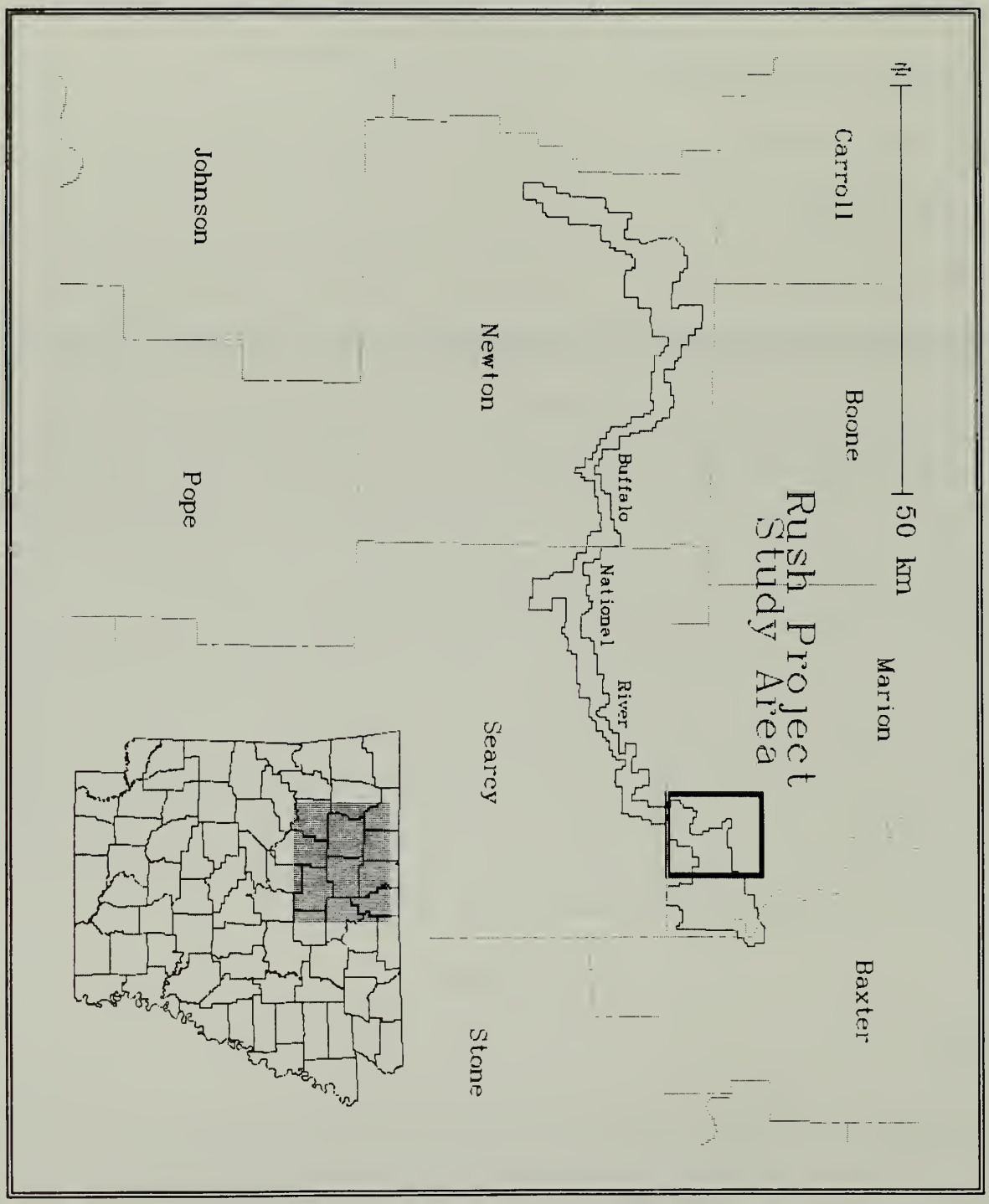


Figure 3-1. The Rush locality.

DEM, each 30 m cell in the study area was scored for elevation. The original sources of the information were the 7.5 minute USGS quadrangle maps for the area. For reporting purposes, the individual elevation values for the Buffalo National River area were reclassed into 15 classes, of which 8 occur in the Rush study area. The distribution of the elevation values is shown in Table 3-1 and Figure 3-2. Elevation classes 1 and 2 (350 - 596) are largely within the Buffalo River Valley proper, while classes 5 through 8 (849 - 1,344 feet) are the ridge tops and upland areas. Intermediate elevations largely occur on the steep slopes between the floodplain and uplands.

Table 3-1. Elevation classes in the Rush locality.

cat #	Name	% no cat 0	hectares
1	350 - 472 feet	1.23	160.47
2	475 - 596	10.53	1,370.34
3	600 - 721	16.87	2,194.29
4	724 - 846	24.34	3,165.84
5	849 - 970	26.89	3,497.94
6	974 - 1095	16.32	2,123.55
7	1098 - 1220	3.58	465.93
8	1223 - 1344	0.23	29.88
	Totals	100.00	13,008.24

Slope

Digital values for each 30 m cell were computed by the software from the elevation data. The slope values are shown in Table 3-2 and Figure 3-3. The 41 slope classes of the original data have been grouped into six classes for ease of reporting.

Table 3-2. Slope class in the Rush locality.

cat #	Name	% no cat 0	hectares
1	Level to nearly level	3.19	416.13
2	Gently sloping	11.15	1,450.8
3	Strongly sloping	22.72	2,954.7
4	Moderately steep	42.39	5,513.6
5	Steep to very steep	20.45	2,660.5
6	Cliff	0.10	12.51
	Totals	100.00	13,008.24

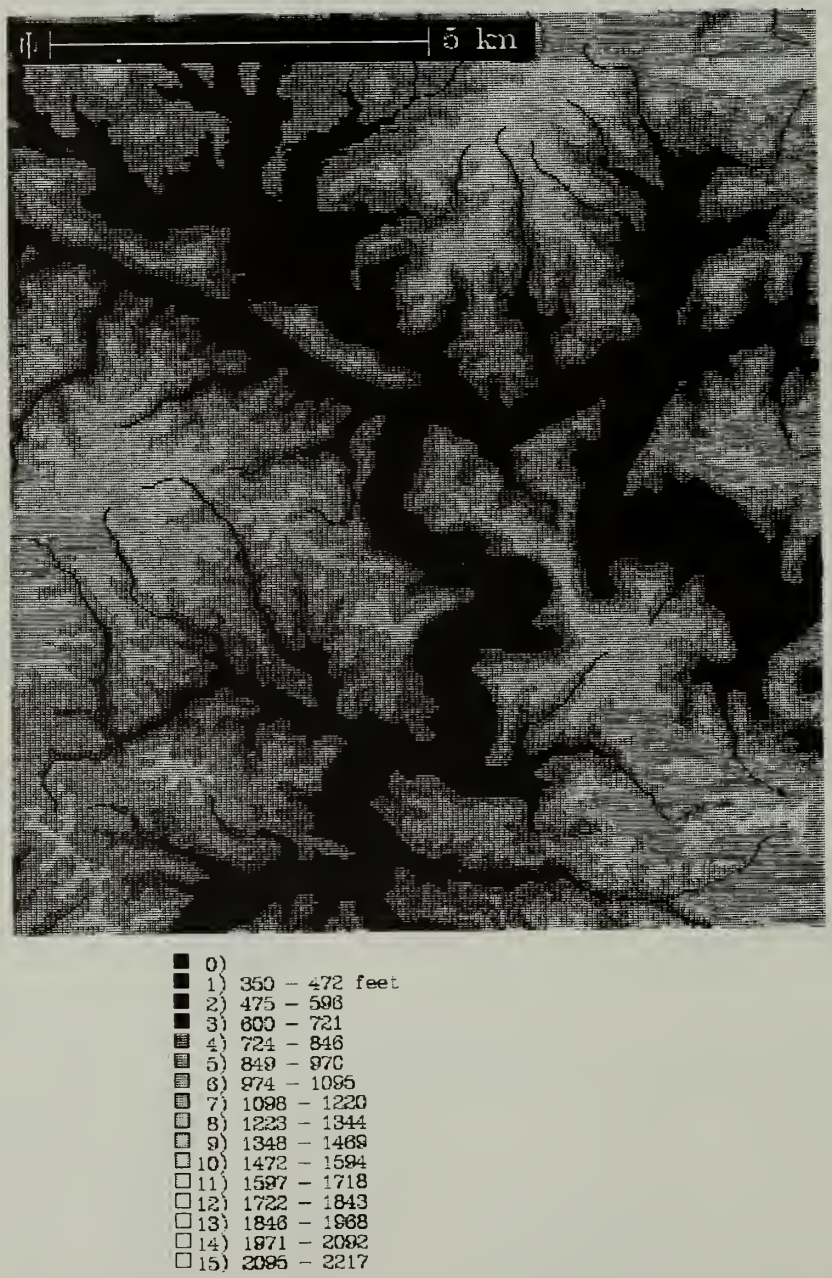


Figure 3-2. The distribution of elevation classes in the Rush locality. Streams are shown. The Rush site is shown by a square.



Figure 3-3. Slope classes in the Rush locality. Stream courses are shown.

Aspect

Aspect values were also computed from the elevation values. The 26 original categories have been re-classed and are shown in Table 3-3 and Figure 3-4. As the stream development pattern is dendritic in the area, no single group of aspect values dominate.

Table 3-3. Major aspect classes in the Rush locality.

cat #	Name	% no cat 0	hectares
1	East	20.36	2,648.1
2	North	29.33	3,814.9
3	West	19.78	2,572.4
4	South	30.52	3,970.0
5	No aspect	0.02	2.84
	Totals	100.00	13,008.24

Soils

Soil mapping units were manually digitized using the SCS county soils book (USDA SCS 1978) as a source. Soil boundaries were transferred to a mylar base from the soil maps--adjusting, as much as possible, for the non-planametric nature of the data source. The mylar product was georeferenced using a series of common reference points visible on both the soils maps and the USGS quadrangle maps. The resulting digital data-product was stored as an arc-node data set. This data was then converted to a 30 m cell form for analysis. There are 18 soil mapping units within the area, with some 1,573 hectares for which no soils data was available. The distribution of some of the mapping units is shown in Figure 3-5 and tabulated in Table 3-4. Four map units dominate. Almost 37 percent of the area (for which data is available) is mapped as the Estate-Portia-Moko (steep) association and a further 11 percent is the same association but rolling. The Clarksville very cherty silt loam represents 28 percent of the area and the Nixa very cherty silt loam follows with 16 percent. Taken together, these map units represent some 90 percent of the area's mapped soils. Generally these soils are on upland and steep slope locations. Soils of interest, but with small total areas, include the Wideman and Razort loams, located on the Buffalo River floodplain, and the Portia soils. These latter soils have more substantial agricultural/horticultural potential than the other soils.

Agricultural potential

Using the soils information, an agricultural potential map was prepared by reclassing the soil mapping units into four classes. The evaluation of agricultural capabilities utilized the published soil survey data along

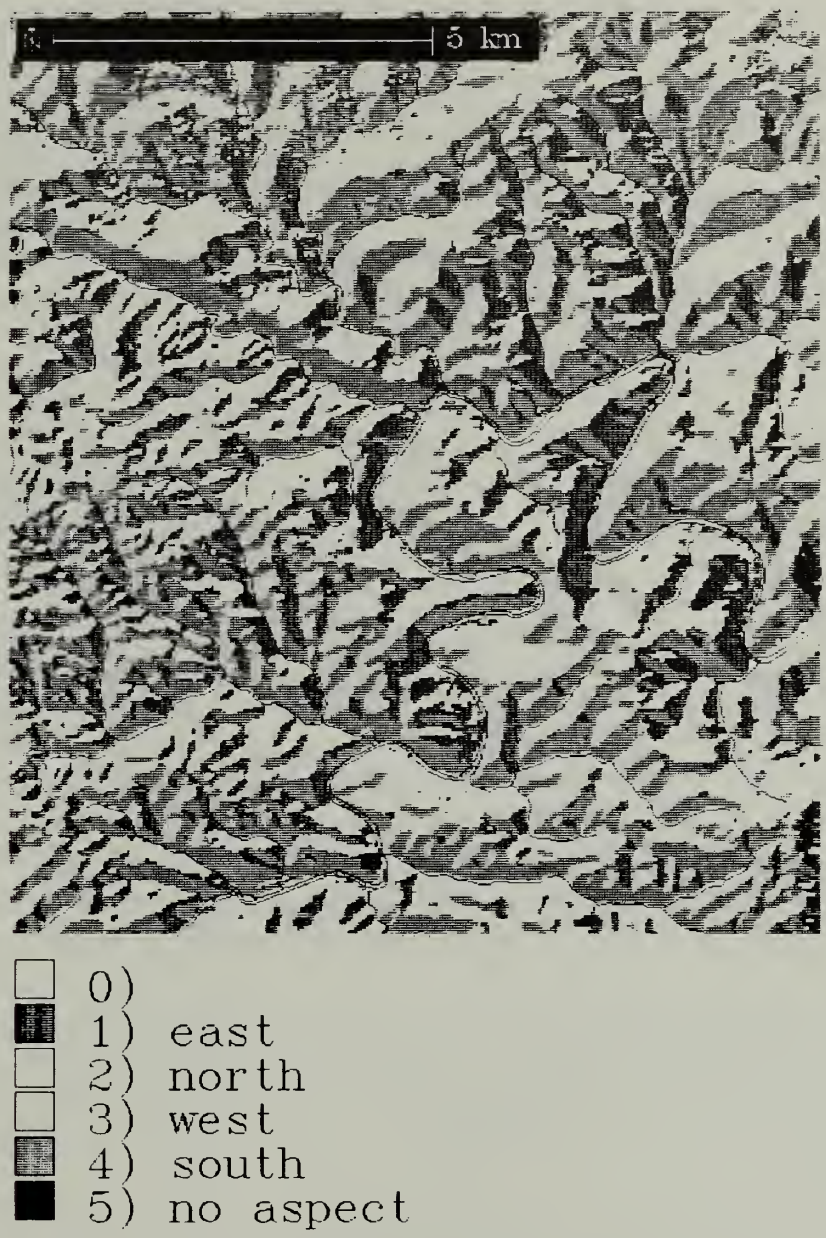


Figure 3-4. Aspect classes in the Rush locality. Stream courses are shown.

Figure 3-5. Distribution of major soil units in Rush locality.

Table 3-4. Soil mapping unit distribution in the Rush locality.

cat #	Name	% no cat 0	hectares
0	No soils data available	0.00	1,573.74
1	Estate-Portia-Moko association, steep	36.99	4,229.82
2	Clarksville very cherty silt loam, 20 to 50 percent	28.01	3,202.92
3	Nixa very cherty silt loam, 8 to 12 percent slope	15.63	1,787.22
4	Estate-Portia-Moko association, rolling	10.62	1,214.46
5	Wideman sandy loam, frequently flooded	3.08	351.63
6	Moko-Rock outcrop complex, 15 to 40 percent slope	1.43	163.98
7	Water	0.95	108.45
8	Britwater silt loam, 3 to 8 percent slope	0.72	82.26
9	Nixa-Noark complex, 8 to 20 percent slope	0.62	71.01
10	Portia fine sandy loam, 8 to 12 percent slope	0.49	56.07
11	Razort silt loam, frequently flooded	0.43	49.50
12	Portia fine sandy loam, 3 to 8 percent slope	0.36	40.68
13	Noark very cherty silt loam, 8 to 20 percent slope	0.30	34.02
14	Arkana-Moko complex, 20 to 40 percent slope	0.22	24.84
15	Nixa-Noark complex, 3 to 8 percent slope	0.10	11.16
16	Britwater silt loam, 1 to 3 percent slope	0.04	4.32
17	Britwater gravelly silt loam, 3 to 8 percent slope	0.02	1.98
18	Nixa very cherty silt loam, 3 to 8 percent slope	0.00	0.18
	Totals	100.00	13,008.24

with a consideration of the possible horticultural/agricultural crops that might have been used by the Rush site inhabitants. These crops included maize, squash/gourd, little barley, maygrass, amaranth, lambsquarter, knotweed, and sumpweed. These crops were equated with the modern crops of corn, truck crops, small grains and, possibly, forages. The four classes assigned were primary, secondary, marginal, and unlikely. The distribution and amounts of these areas are shown in Figure 3-6 and Table 3-5.

Primary: Soils in this category are well suited to moderately suited for cultivated crops such as corn, soybeans, small grains, truck crops, and improved pastures. Erosion is the major limiting factor. Soils included in this category were Britwater silt loam, 1 to 3 and 3 to 8 percent slopes; Britwater gravelly silt loam, 3 to 8 percent; and Portia fine sandy loam, 3 to 8 percent.

Secondary: Soils in this category are only moderately suited to cultivated crops and pasture. The main limitation is stony/shallow soil. Included in this group is the Razort silt loam which frequently floods and therefore is not classed as a primary soil. However, in the years it does not flood, it produces good yields of

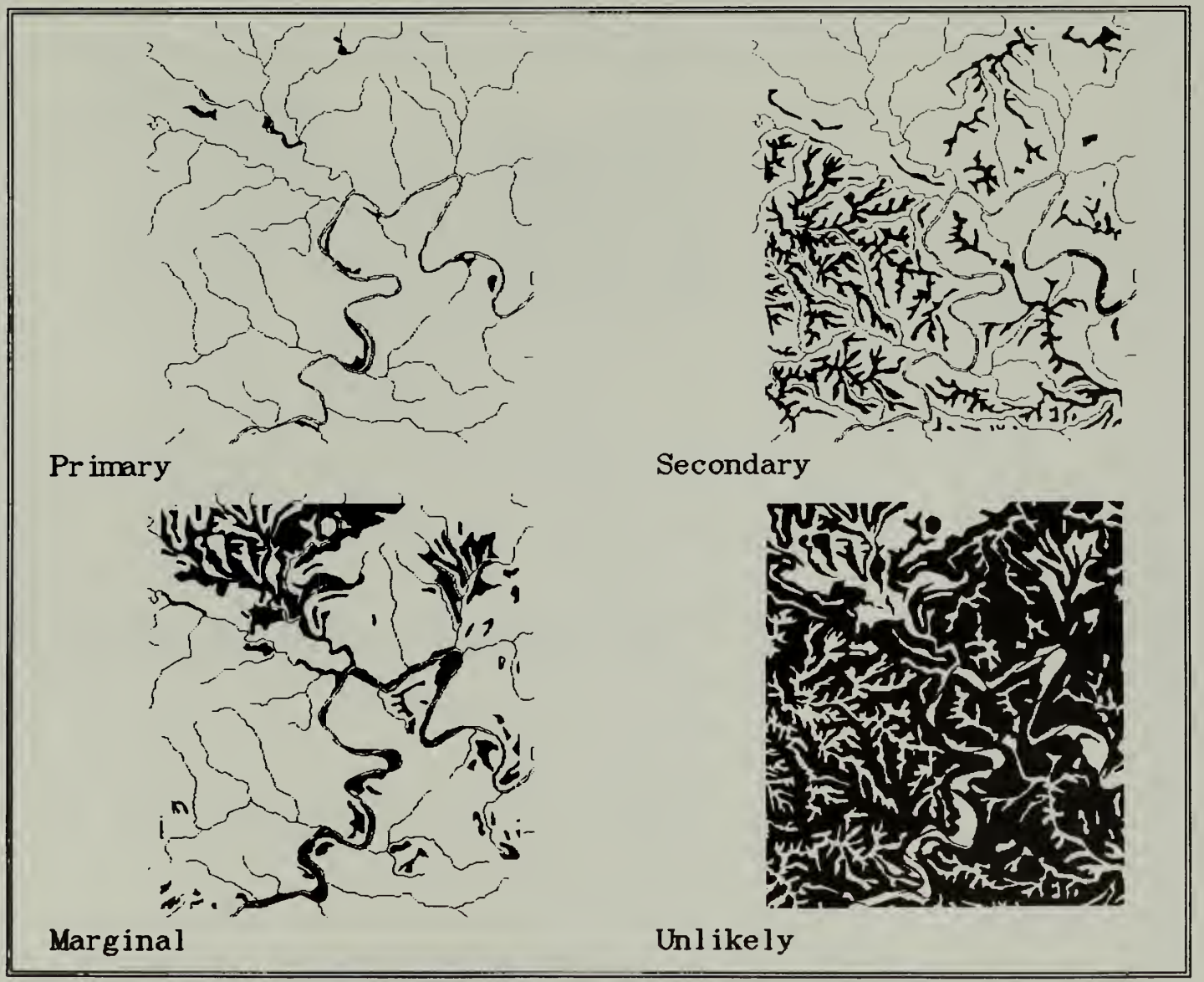


Figure 3-6. Distribution of agricultural soils in the Rush locality.

Table 3-5. Distribution of soils with agricultural potential.

cat #	Name	% no cat 0	hectares
0	No soils data available	0.00	1,573.74
1	Primary	1.13	129.24
3	Secondary	16.16	1,848.06
4	Marginal	15.11	1,727.19
5	Unlikely	67.60	7,730.01
	Totals	100.00	13,008.24

late maturing crops. The other soils in this class are located on ridges: Nixa very cherty silt loam, 3 to 8 and 8 to 12 percent; and Nixa-Noark complex, 3 to 8 percent.

Marginal: Soils in this class are not viewed as suitable for modern crops but are moderately suited for pasture. Limitations include erosion, stony/shallow soils and steep slopes. Small areas included within the map units may be suitable for agriculture. Soils included in this category are: Estate-Portia-Moko association, rolling; Nixa-Noark complex, 8 to 20 percent; Noark very cherty silt loam, 8 to 20 percent; Portia fine sandy loam, 8 to 12 percent, and Wideman sandy loam, frequently flooded.

Unlikely: Soils in this category are not viewed as suitable for modern agriculture or improved pasture. Limitations include steep slopes, surface stones/outcrops and escarpments. Soils included in this category are: Arkana-Moko complex, 20 to 40 percent; Clarksville very cherty silt loam, 20 to 50 percent; Estate-Portia-Moko association, steep; and Moko-Rock outcrop complex, 15 to 40 percent slopes.

While these classifications are based on modern soils mapping practices and assessments and should be used with appropriate caution, they can provide considerable insight into locations which may have been favorable for aboriginal horticulture/agriculture.

Geology

Mapped geological units had been converted previously to a digital form for the entire state using a 250 m cell resolution. The data was manually digitized from the statewide geological map distributed by the USGS at a 1:500,000 scale. The geological classes mapped for the study area are shown in Figure 3-7 and Table 3-6.

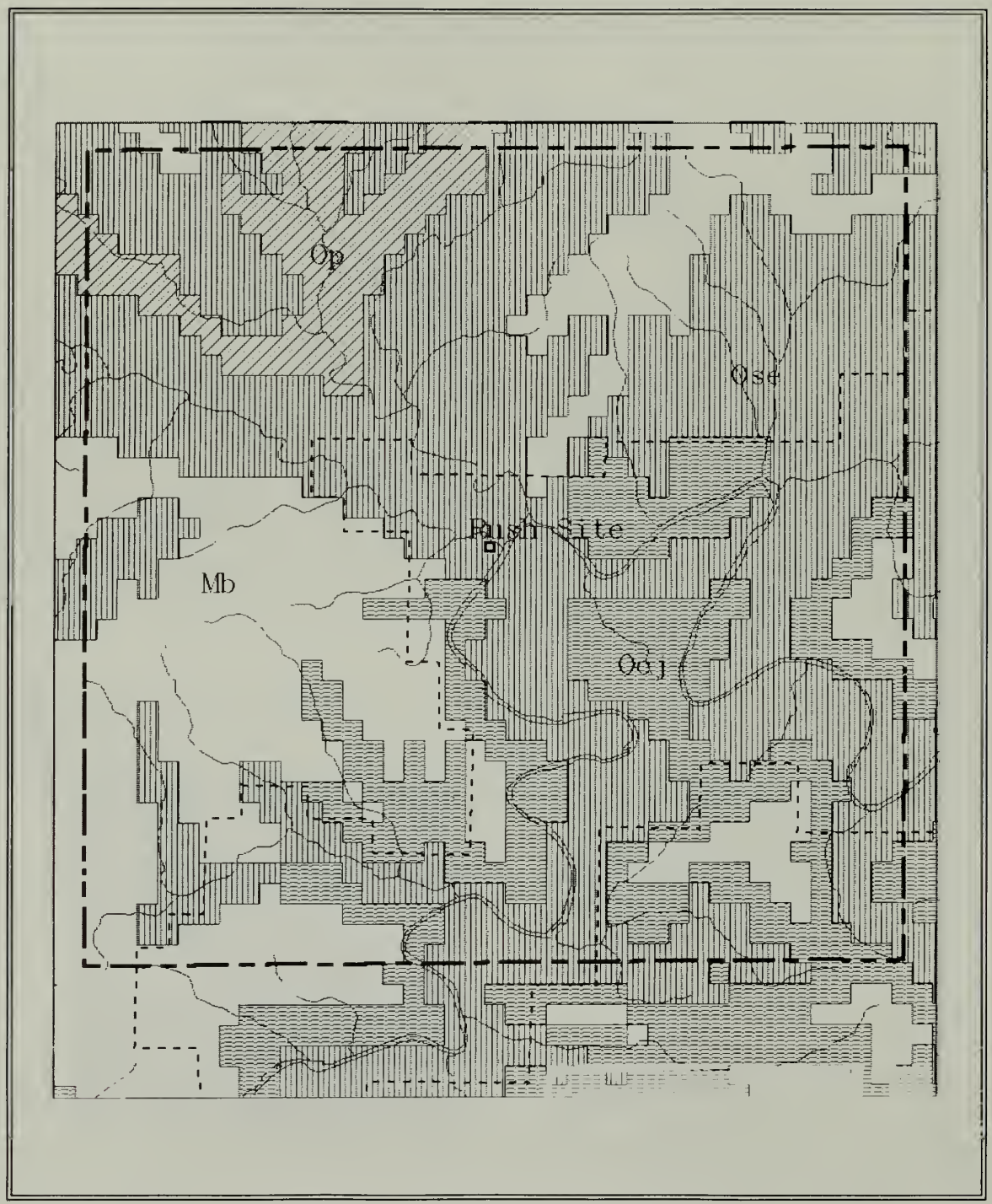


Figure 3-7. Geological units in the Rush locality. Mb = Boone formation, Ocj = Carson shale, Ose = St. Peter sandstone and Everton formation, Op = Powell dolomite.

Table 3-6. Geological units in the Rush locality.

cat #	Name	% no cat 0	hectares
35	Mb--Boone formation	26.92	3,502.35
38	Ocj--Carson shale, Fern., Kimm., Plat., lsn., and Joac	19.47	2,532.78
39	Ose--St. Peter sandstone and Everton formation	48.15	6,263.46
40	Op--Powell dolomite	5.46	709.65
	Totals	100.00	13,008.24

Only four map units are present in the immediate area, the Boone formation, Carson shale-Ferndale, St. Peter sandstone-Everton formation, and the Powell dolomite. The St. Peter sandstone-Everton formation dominates with almost 50 percent of the area.

Relative Location

The data layer relative location was derived from relating soils to parent material and topography. The Springfield Plateau region is subdivided into the upper ridges and ridge slopes and the steep upper slopes occupying approximately 45 percent of the Rush study area. The uplands of the Salem Plateau occupy 50 percent of the area comprised of lower ridges, upland moderate slopes, lower steep slopes. The other 5 percent of the area is made up of old stream terraces and floodplains. The distribution of these location classes are shown in Table 3-7 and Figure 3-8.

Table 3-7. Distribution of relative location classes.

cat #	Name	% no cat 0	hectares
0	No location class	0.00	1,573.6
1	Upper ridges and ridge slopes	16.65	1,903.6
2	Steep upper slopes	28.01	3,202.9
3	Upland moderate slopes	0.85	96.8
4	Lower ridges and ridge slopes	0.22	24.8
5	Lower steep slopes	38.43	4,393.8
6	Lower rolling slopes	10.62	1,214.5
7	Old stream terraces	0.77	88.6
8	Floodplains	4.46	509.6
	Totals	100.00	13,008.24

Figure 3-8. Distribution of relative location classes and, for reference, aspect.

Hydrography

Vector digital maps (arc-node) for the area's streams and other water bodies were obtained from the USGS NCIC in Digital Line Graph-3 format. Data (from the USGS 1:100,000 metric quadrangle sources) was read into the GRASS system and retained in its vector (arc-node) format as well as transferred to a cell form at 30 m resolution. These data generally compare very favorably with the stream data from the USGS 7.5 minute quadrangle (1:24,000 scale), except that the smaller, particularly intermittent, streams are shown. The vector form of the hydrography has been displayed on a number of the figures as an overlay.

Distance to streams

Using the cell form of the hydrography data, a distance to streams digital map was prepared. These data are displayed in Table 3-8 and Figure 3-9. As can be seen, a great majority of the area is in relatively close proximity to a mapped stream. Some 20 percent are within 90 m and more than 99 percent are within 1 km.

Table 3-8. Distance to streams.

cat #	Name	% no cat 0	hectares
0	Location from which distances calculated	0.00	529.92
1	0.00 to 90.00 meters	20.00	2,495.70
2	90.00 to 180.00 meters	18.88	2,355.93
3	180.00 to 270.00 meters	17.03	2,125.26
4	270.00 to 360.00 meters	14.52	1,811.43
5	360.00 to 450.00 meters	10.93	1,364.13
6	450.00 to 540.00 meters	7.85	979.92
7	540.00 to 630.00 meters	4.82	602.01
8	630.00 to 720.00 meters	2.92	364.32
9	720.00 to 810.00 meters	1.79	223.56
10	810.00 to 900.00 meters	0.95	118.44
11	900.00 to 990.00 meters	0.29	36.00
12	990.00 to 1,500.00 meters	0.01	1.62
	Totals	100.00	13,008.24

Modern Vegetation

Modern vegetation mapping is available for selected portions of the Buffalo River Valley as a result of work conducted by the Arkansas Water Resources Research Center between 1973 and 1977 and reported in Babcock et al. (1978). Through the courtesy of Dr. Edward E. Dale, University of Arkansas, vegetation maps

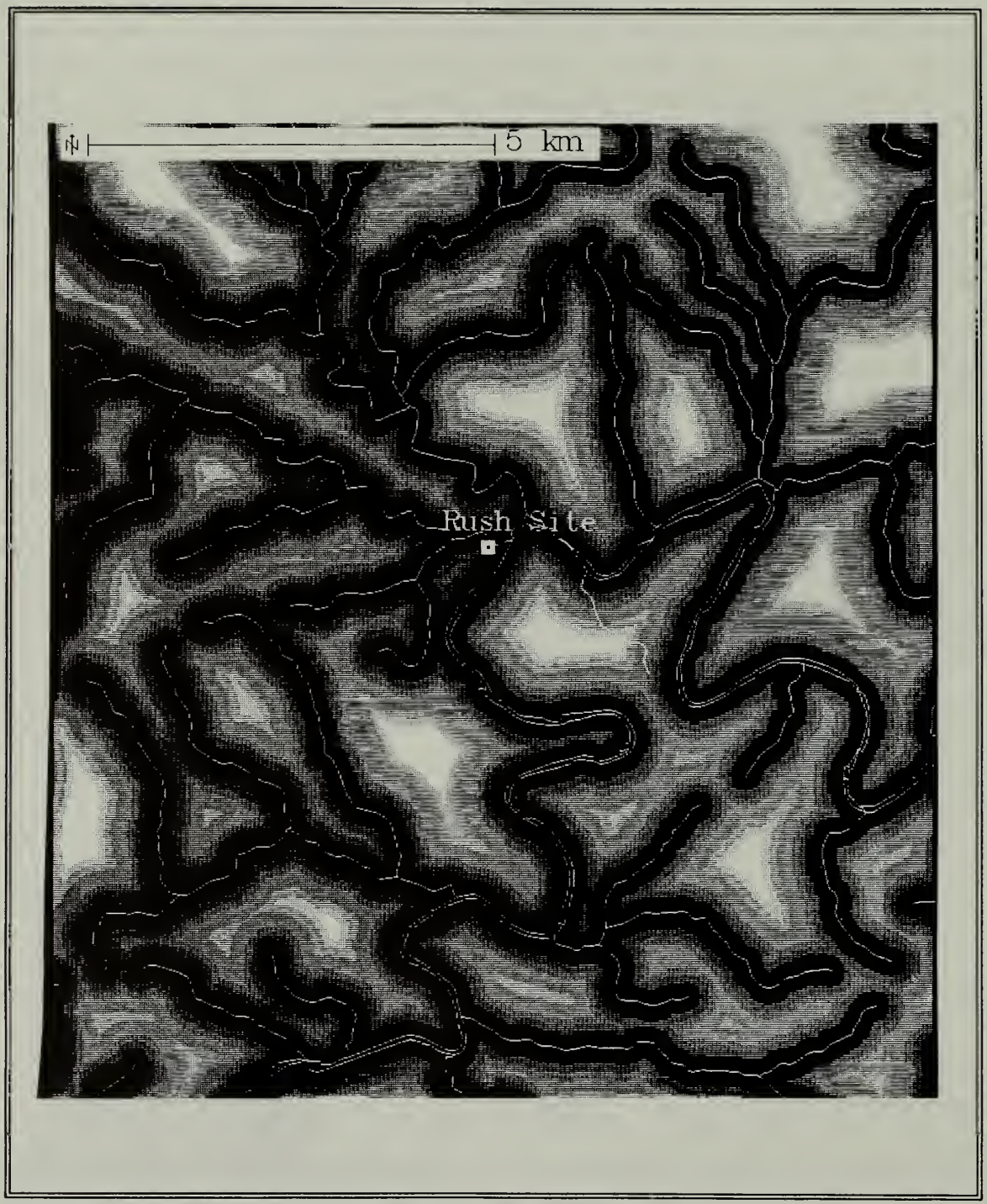


Figure 3-9. Distance to streams.

based on aerial photograph mosaics of the Rush area were obtained. Data were available for some 4,600 hectares of the Rush study area. The photos were not orthophotos and as a result geometric distortion is present, particularly in the northeastern portion of the map.

The vegetation map was created by digitizing the aerial mosaic of the Buffalo National River on which the vegetation communities were delineated. Note that even though lines are drawn delineating plant communities, transition zones usually separate individual types. Major vegetation communities were determined by Dale in field studies and mapped using aerial photography, high oblique aerial transparencies, and ground observation.

The central and southern parts of the map appear to correspond well to other mapped features, so it was felt that production of a digital map was appropriate. Note that the GRASS software does not currently include a full "rubber sheeting" georeferencing module. Current options only include axial transformation, thus differential error across an aerial mosaic cannot currently be corrected. The resulting vector data was stored in arc-node form and converted to cell format for analysis at a 30 m cell resolution. Table 3-9 and Figure 3-10 display this data. Since the mapping was limited to the Park boundaries, the floodplain areas as well as the adjacent slopes are over-represented in comparison to the entire study area. In contrast, the uplands generally--and specifically the rolling uplands--are substantially underrepresented. Upland areas across the Buffalo River and to the southeast from the Rush site are present, as are similar uplands to the southwest. Unfortunately, the uplands immediately to the northwest of the site are outside of the Park and are therefore not

Table 3-9. Distribution of vegetation classes.

cat #	Name	% no cat 0	hectares
0	No data	0.00	8,407.35
1	C Cutover area	0.06	2.79
2	F Open areas (fields)	2.04	93.96
3	D Disturbed areas	2.19	100.89
4	FL Floodplain forest	6.49	298.62
5	MH Mixed Hardwoods	1.49	68.76
6	OH Oak-Hickory	48.94	2,251.53
7	OP Oak-Pine	2.99	137.43
8	CG Cedar Glade	34.61	1,592.37
10	POH Possible Oak-Hickory	0.92	42.12
11	POF Possible field	0.02	0.81
12	PCG Possible Cedar Glade	0.05	2.34
13	POP Possible Oak-Pine	0.20	9.27
	Totals	100.00	13,008.24



Figure 3-10. Distribution of vegetation classes.

mapped. Even with the absence of many adjacent upland areas, the Oak-Hickory vegetation zone dominates, covering almost one half of the area for which modern vegetation mapping was available. The Oak-Hickory zone is primarily in the upland areas, particularly the rolling upland areas. The second most common vegetation zone is the Cedar Glade, encompassing some 35 percent of the mapped area. Floodplain forest is found immediately adjacent to the Rush site, and areas of Mixed Hardwoods are also nearby. The modern mapping also identified areas of agricultural fields and disturbed areas.

The alphabetical keys used to denote the plant communities on the map, and a brief discussion of each, are listed below (after Dale and Kuroda 1978).

C: Cutover Areas. May be any forest type; usually dominated by small trees.

F: Open Areas. Usually cultivated fields or pastures with few or no trees.

D: Disturbed Areas. Areas not entirely C or F or areas that contain buildings, campgrounds, etc.

FL: Floodplain Forest Type. Areas composed mostly of American elm, green ash, silver leaf maple or box elder that are on low flat areas subject to flooding. Streamside species include sycamore, black river birch, black willow or cottonwood. Gravel bar areas are dominated by Ward's willow or sandbar willow.

MH: Mixed Hardwood Type. Transition type between Floodplain and Oak-Hickory, Oak-Pine, or Cedar Glade typically occurring in moist areas on north-facing slopes above the river and along mesic small streams and upland ravines. Species in this area include those common to the Oak-Hickory and Oak-Pine, as well as American elm, green ash, silverleaf maple, sweetgum, white ash, bitternut hickory, hackberry, blackgum, black walnut, shumard oak, and white oak.

OH: Oak-Hickory Type. This type is the most extensive of all types, occurring on south-facing slopes, hilltops, and dry upper north exposures. Species common to this type include post oak, blackjack oak, black oak, mockernut hickory, and white oak, with dogwood frequently dominating the understory.

OP: Oak-Pine Type. This type occurs in patches and on soils derived from sandstone or shales on uplands. Upland species of oaks and short-leaf pines dominate this type. Pine may occupy 10-40 percent of the stand.

CG: Cedar Glade Types. Cedar glades occur almost exclusively on soil derived from limestone or dolomite on the tops and sides of bluffs in dry areas, and on the sides of tributary ravines with thin soils. They frequently invade abandoned fields. Red cedar dominates with a high variable vegetation composition. In the drier areas, grasses occur along with the cedar. Oak and hickory tend to be associated with mature glades, and white cedar sometimes accompanies red cedar.

BE: Beech Type. This type is found almost exclusively on north-facing slopes and moist ravines mostly in the western part of the valley. Beech dominates this type.

GLO Vegetation Reconstruction

Reconstruction of the landscape of presettlement vegetation for the 120 square km area surrounding the Rush site was made from field notes of the General Land Office (GLO). The surveyors for the GLO recorded witness trees and line trees by noting the range and bearing of each tree with respect to the origin and direction of the surveys conducted at each section boundary. Tree data were recorded from the original surveys into an INFORMIX relational database management system and integrated into GRASS for display and analyses. Locational information for each tree was determined by using a computer program written in C to convert the chain, bearing, and range data into UTM coordinates. Once the location was in UTM coordinates, a site list could be used by GRASS.

In addition to the GLO survey there have been several more recent reports on the ecosystems in the Buffalo River region. In a M.S. thesis published in 1976, S. W. Bailey (1976) correlated soil characteristics with occurrences of various tree species within the Buffalo River region. In a 1973 report on the Buffalo River ecosystems, E. E. Dale (1978) related his tree community grouping to parent material and moisture regimes due to aspect. It was further suggested by R. A. Read (1952) "that major variations in forest composition and forest site productivity may be explained by soil differences attributable to different parent rock materials." This may be especially pertinent in small areas of uniform climate. From these studies on the occurrence of various tree species in the Ozarks, soils (mapping units, series, order), slope, aspect, and relative location with respect to parent material and topography were the environmental variables selected for possible correlation with tree species occurrence. The site list module was used to gather the environmental factors from other data layers within GRASS that described the location of each tree. The data set containing tree species and environmental descriptors was then output as a text file for all 493 trees. This file was edited to a format suitable for statistical analysis by SAS (Statistical Analysis System).

Any statistical analyses of GLO forest data must be conducted in light of knowledge of a number of potential limitations with these data ranging from falsified data to the use by the surveyors of common tree names in an inconsistent or incorrect manner. As a result, an analysis such as follows should be viewed with a proper amount of caution, but it provides, nevertheless, an unmatched opportunity to consider forest composition and distributions.

Statistical Analysis

The data set was summarized by frequency counts of the combinations of tree species and associated environmental parameters. The PROC FREQ module within SAS was used to generate contingency tables

which used the chi-square distribution to test the independence of the tree species and the individual environmental parameters of slope, aspect, soils, and relative location. The environmental parameters as they exist in the GIS data layers are presented in Table 3-10. The null hypothesis was that the environmental parameter being tested gives no clue as to what proportion of tree species or collection of tree species was present. The chi-square distribution was used to test the null hypothesis that there was no difference between the observed and theoretical frequency of occurrence.

Results of the test were expressed as a p-value which indicates the amount of agreement between the observed data and the null hypothesis.

There were 493 trees sampled in the original survey of the Rush site area representing 19 different tree species (Table 3-11). Black Oak at 27 percent, White Oak at 22 percent, and Pine at 22 percent were the most common trees in the area comprising 71 percent of the sample. If added with Post Oak at 10 percent and Hickory at 5 percent, the top five tree species compose 86 percent of the total number of trees surveyed. Therefore, Black Oak, White Oak, Pine, Post Oak, and Hickory existed in large enough sample sizes to warrant separate analysis. These individual tree species were analyzed in proportion with all other species grouped together and tested for independence by chi-square.

Individual Tree Species

Within the Rush study area, Black Oak locations were related to relative location, aspect, and soils. Black Oak was found most commonly in the lower rolling slopes of the Salem Plateau and the upper ridges and ridge slopes of the Springfield Plateau, on eastern aspects, and on Estate-Portia-Moko soil association, rolling and Nixa very cherty silt loam soils. These parameters suggested that Black Oak, although ubiquitous in the Rush area, was found in the slightly more mesic regime.

White Oak locations were found to be significantly related to aspect, soil series, and soils. The White Oak species was most commonly found on western aspects followed by northern aspects. Within the soil series and soil mapping units categories, White Oak was most commonly found on the Razort silt loam followed by the Britwater silt loam.

The Pine in the Rush study area were significantly related to relative location, aspect, and soil order. This tree species was found to be most common in the upper ridges and ridge slopes of the Springfield Plateau followed by the steep upper slopes of the same parent material. Pine was mostly located on southern aspects and on soils included in the soil order Ultisols. Pine as indicated here thrives in dryer conditions found in the Rush locality.

Table 3-10. GIS Data layers used in GLO presettlement vegetation reconstruction.

Soil Mapping Units		Percent
1	Estate-Portia-Moko Association, steep	36.99%*
2	Clarksville very cherty silt loam, 20-50% slopes	28.01%*
3	Nixa very cherty silt loam, 8-12% slopes	15.63%*
4	Estate-Portia-Moko Association, rolling	10.62%*
5	Wideman sandy loam, frequently flooded	3.08%*
6	Moko-Rock outcrop complex, 15-40% slopes	1.43%*
7	Water	.95%*
8	Britwater silt loam, 3-8% slopes	.72%*
9	Nixa-Noark complex, 8-20% slopes	.62%
10	Portia fine sandy loam, 8-12% slopes	.49%
11	Razort silt loam, frequently flooded	.43%*
12	Portia fine sandy loam, 3-8% slopes	.36%
13	Noark very cherty silt loam, 8-20% slopes	.30%
14	Arkana-Moko complex, 20-40% slopes	.22%
15	Nixa-Noark complex, 3-8% slopes	.10%
16	Britwater silt loam, 1-3% slopes	.04%
17	Britwater gravelly silt loam, 3-8% slopes	.02%
18	Nixa very cherty silt loam, 3-8% slopes	.002%

Soil Series		Percent
1	Estate-Portia-Moko association	47.61%*
2	Clarksville	28.01%*
3	Nixa	15.63%*
4	Wideman	3.08%*
5	Moko-Rock outcrop complex	1.43%*
6	Water	.95%*
7	Britwater	.77%*
8	Nixa-Noark complex	.72%
9	Portia	.85%
10	Razort	.43%*
11	Noark	.30%
12	Arkana-Moko complex	.22%

Soil Order		Percent
1	Alfisols	2.05%*
2	Ultisols	46.09%*
3	Entisols	4.02%*
4	Alfisols/Ultisols	47.83%*

* Soils containing samples.

Table 3-10. Continued.

Relative location with respect to parent material and topography		Percent
1	Upper ridges and ridge slopes	16.65%*
2	Steep upper slopes	28.01%*
4	Upland moderate slopes	.85%
5	Lower ridges and ridge slopes	.22%
6	Lower steep slopes	38.43%*
7	Lower rolling slopes	10.62%*
8	Old Stream Terraces	.77%*
9	Floodplain	4.46%*
Slope		**Percent**
1	Level to nearly level	3.19%*
2	Gently sloping	11.15%*
3	Strongly sloping	22.72%*
4	Moderate steep	42.39%*
5	Steep to very steep	20.45%*
6	Cliffs	0.10%
Aspect		**Percent**
1	East	20.36%*
2	North	29.33%*
3	West	19.78%*
4	South	30.52%*
5	No aspect	.02%

* Areas containing sampled trees.

Table 3-11. Tree species sampled from 120 square kilometer area encompassing Rush site.

Species	Frequency	Percent
Black Oak	135	27.38%
White Oak	109	22.11%
Pine	106	21.50%
Post Oak	48	9.74%
Hickory	26	5.27%
Blackgum	14	2.84%
Sycamore	11	2.23%
Cedar	9	1.83%
Elm	8	1.62%
Red Oak	8	1.62%
Ash	6	1.22%
Maple	3	.61%
Birch	2	.41%
Cherry	2	.41%
Sweetgum	2	.41%
Mulberry	1	.20%
Pin Oak	1	.20%
Sassafras	1	.20%
Sugar Maple	1	.20%
Total	493	100.00%

Post Oak was found to be related to relative location and aspect. Post Oak was mostly found on lower steep slopes and the lower rolling slopes of the Salem Plateau. It was equally distributed on western and southern aspects indicating a tolerance of drier conditions.

Because Hickory was found at only 26 sites, the only significant test statistic was to tie its location to aspect where it tended to be located on southern exposures.

Table 3-12 summarizes the order of environmental parameters describing likely individual tree species location.

Grouped Tree Species

The next step was to analyze the tree species as a group, rather than the individual species, in order to determine if there were significant patterns of species within the landscape. Since the chi-square test only

Table 3-12. Significant environmental parameters with likely tree species location.

Total Chi^2 (P-value)	Parameter	Category Number (*Percent)
Black Oak - Total number sampled = 135		
.003	Reloc	6 (39) 1 (36) 2 (30) 8 (26) 5 (19) 7 (0)
.007	Aspect	E (39) N (28) W (22) S (21)
.020	Soils	4 (39) 3 (36) 6,11 (33) 2 (30) 7 (25) 5 (22) 1 (19) 8 (0)
White Oak - Total number sampled = 109		
.004	Aspect	W (30) N (28) E,S (15)
.030	Series	10 (67) 7 (38) 2 (27) 3 (23) 1 (19) 4,5,6 (0)
.049	Soils	11 (67) 8 (38) 2 (27) 3 (23) 1 (27) 4 (19) 5,6,7 (0)
Pine - Total number sampled = 106		
.057	Reloc	1 (73) 2 (25) 6 (24) 5 (19) 7,8 (0)
.034	Aspect	S (29) W,E (22) N (14)
.017	Order	2 (26) 4 (20) 1,3 (0)
Post Oak - Total number sampled = 48		
.000	Reloc	5 (17) 6 (10) 8 (5) 2 (4) 1 (3) 7 (0)
.062	Aspect	W,S (13) E (10) N (5)
Hickory - Total number sampled = 26		
.048	Aspect	S (10) N (5) E (4) W (2)

* Percentages reflect the proportion of the particular tree species being tested in relation to all other species in that category.

indicates that at least one of the proportions in a given test is significantly different than the others, a pairwise comparison was made on the variables to assess which were different and which were more alike.

The variable tree species was tested against the environmental parameters soils, slope, aspect, and relative location. Slope proved to be nonsignificant in all tests and was dropped from further analyses. When the different groupings of soil were analyzed (soil mapping units, series, order), the soil mapping unit gave the most detailed information. Since relative location and soils were both significant in the testing and since four out of the six locations contained only one soil mapping unit and the other two locations were logical groupings of smaller areas (Table 3-13), the decision was made to use the variable relative location as an indicator of tree species location in the final analysis. Relative location, grouped to reflect parent material, further increased the decision in its favor rather than soils. Aspect again was highly significant and retained in the final analysis. Figures 3-11 through 3-16 display the different distribution for each aspect within the different locations.

Table 3-13. Grouped tree species relative location and soils.

Relative Location		Soils
1	Ridges and ridge slopes (Sp)	Nixa
2	Steep upper slopes (Sp)	Clarksville
5	Lower steep slopes (Sa)	Moko-Rock, E-P-M steep
6	Lower rolling slopes (Sa)	E-P-M rolling
7	Old Stream terraces	Britwater
8	Floodplain	Wideman, Water, Razort

With knowledge that relative location and aspect were important to the grouping of the tree species, the next step was to investigate whether at a given location there was a difference in the grouping due to aspect.

Within ridges and ridge slopes of the Springfield Plateau, no significant differences were found in proportions of tree species due to aspect with a p-value = .656. Even though there were no statistically significant differences, there were some patterns in the data. Although Black Oak dominated in all four aspects, codomination was achieved by Pine in the southern aspect and White Oak in the western aspect because of the slightly drier exposure.

Locations which included the steep upper slopes of the Springfield Plateau, showed no statistically significant differences in tree proportions even though Black Oak dominated in the eastern aspect, White Oak dominated in the northern aspect, Pine and White Oak codominated in the western aspect and Pine dominated in the southern aspect. Even though slope failed to be statistically significant, it is probably the steeper slopes which allow the western and southern aspects to exhibit even drier conditions permitting the higher proportions of pine and drought tolerate oaks.

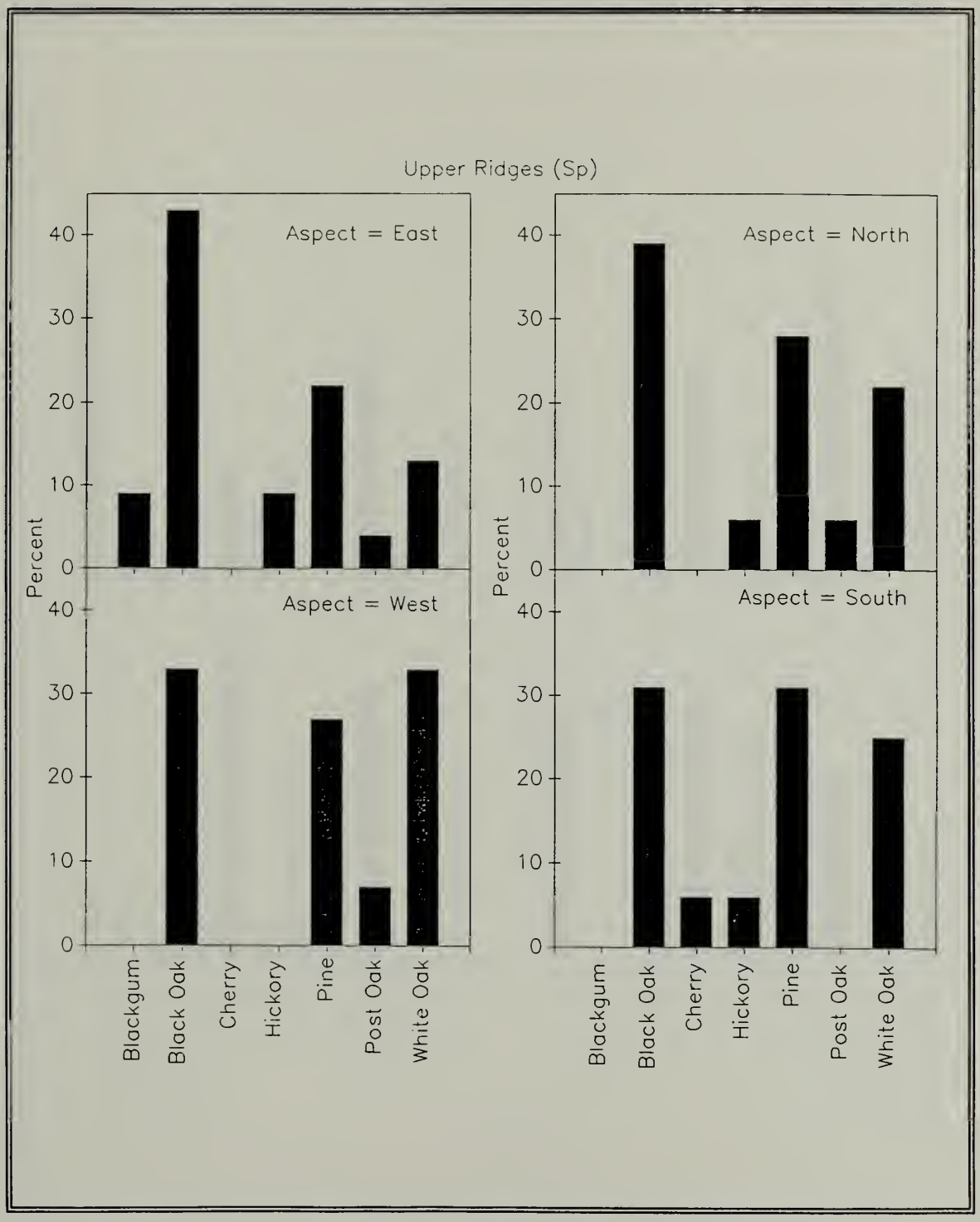


Figure 3-11. Tree distribution by aspect for trees located on the upper ridges.

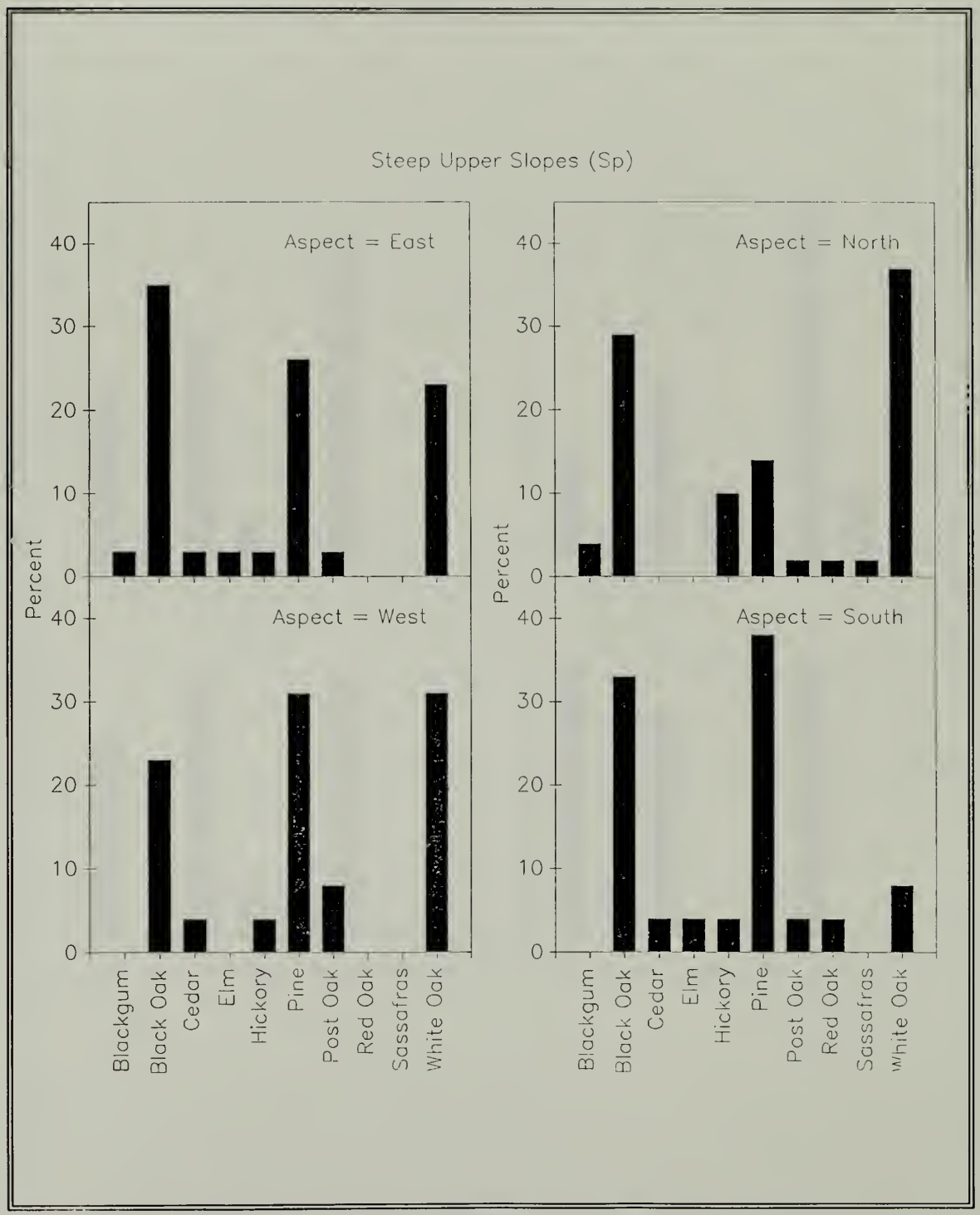


Figure 3-12. Tree distribution by aspect class for trees located on the steep upper slopes.

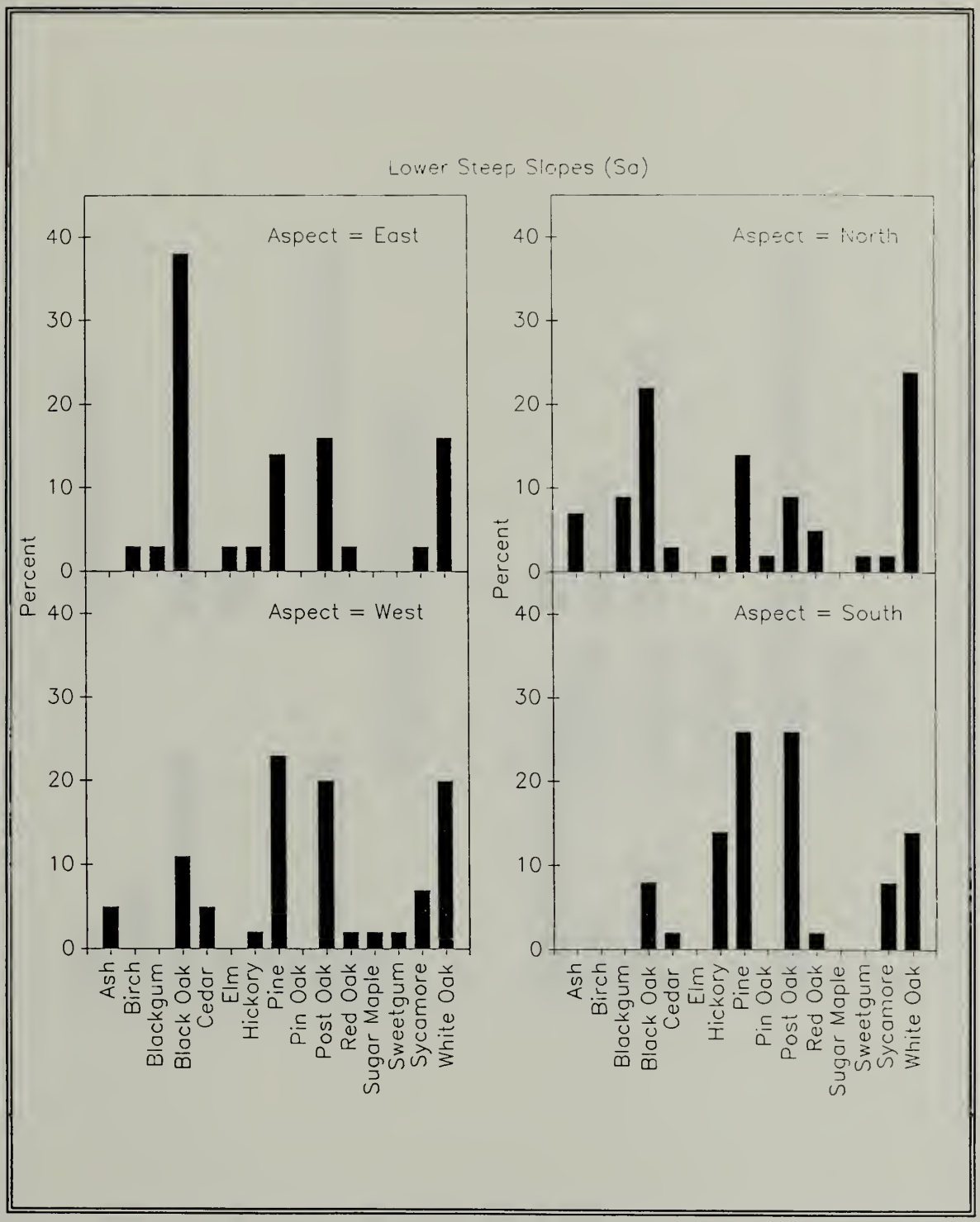


Figure 3-13. Tree distribution by aspect class for trees located on the lower steep slopes.

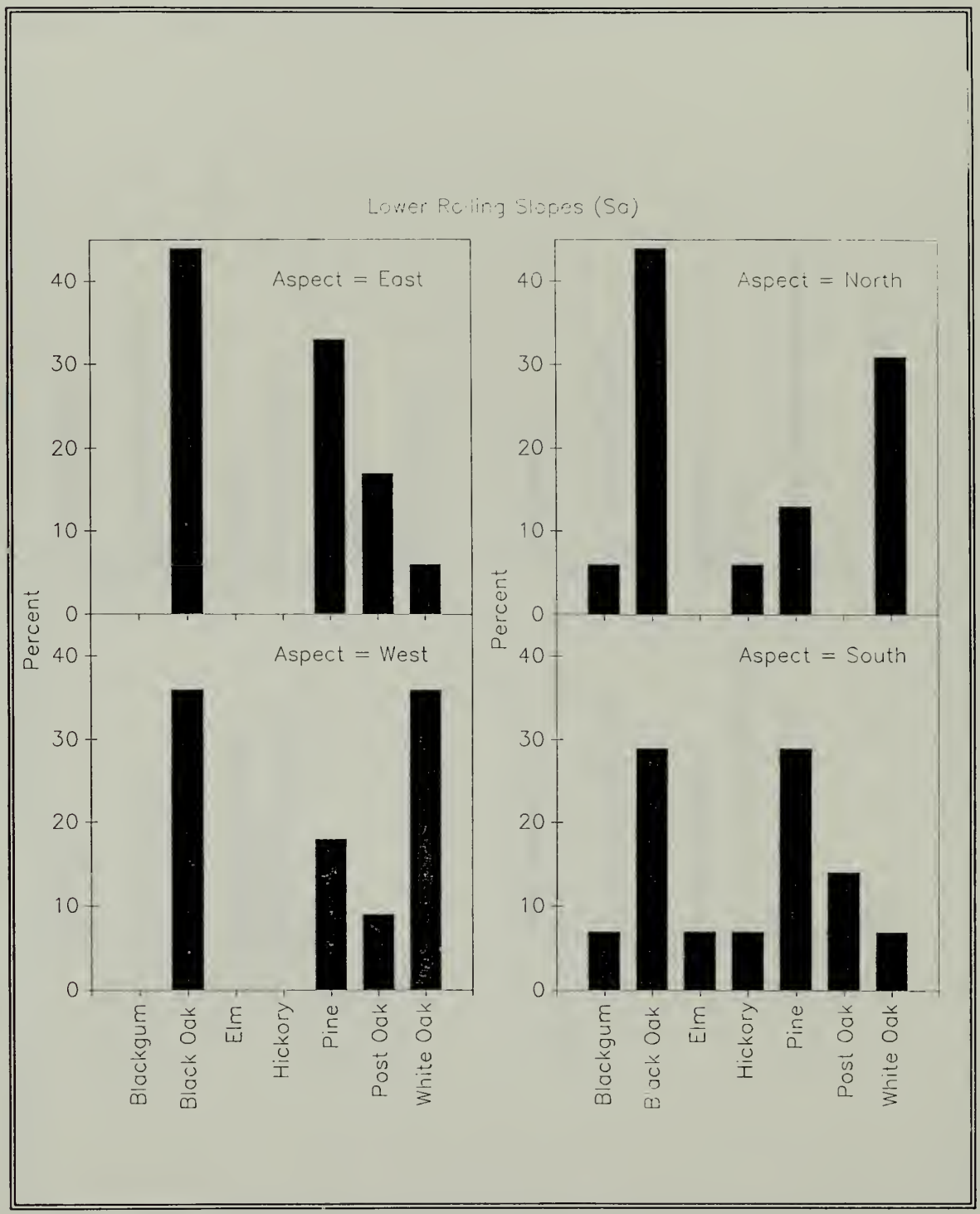


Figure 3-14. Tree distribution by aspect class for trees located on the lower rolling slopes.

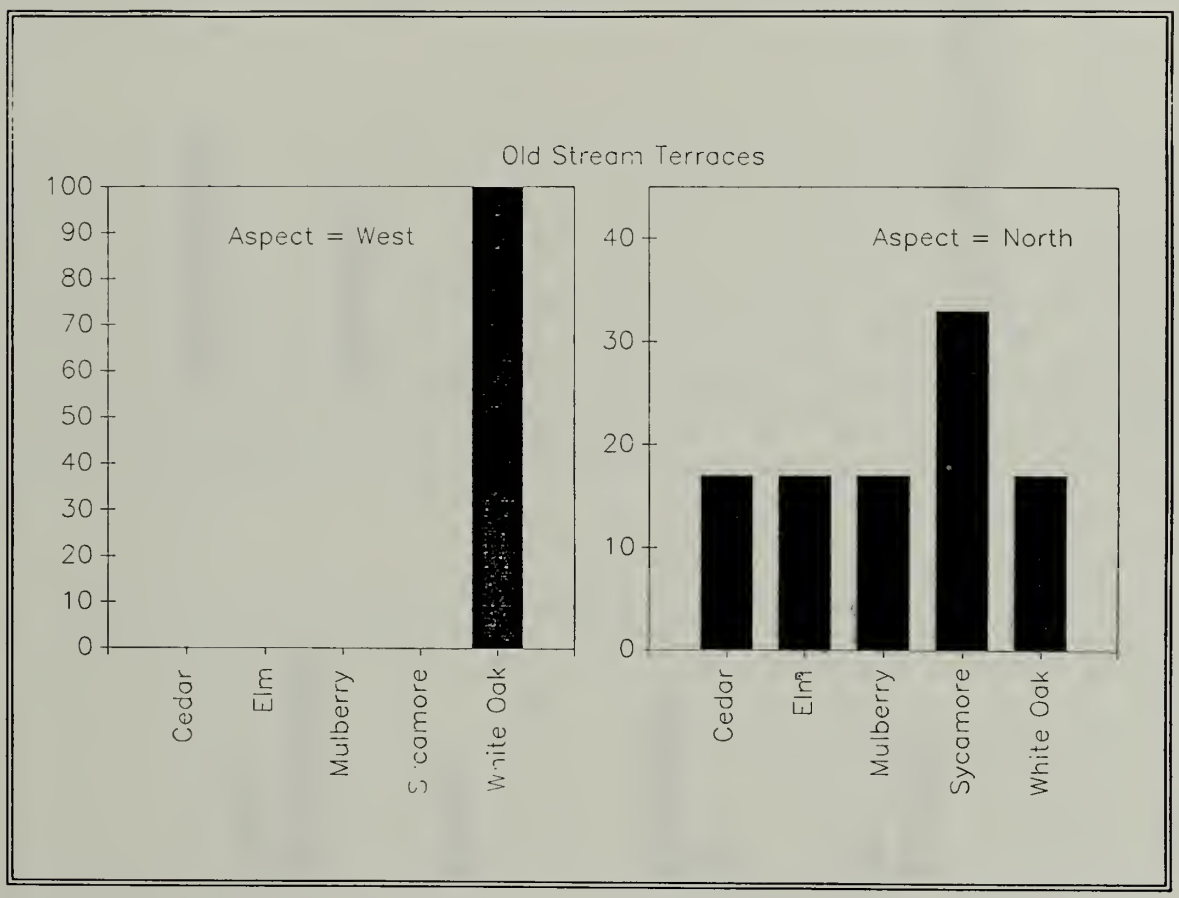


Figure 3-15. Tree distribution by aspect class for trees located on the old stream terraces.

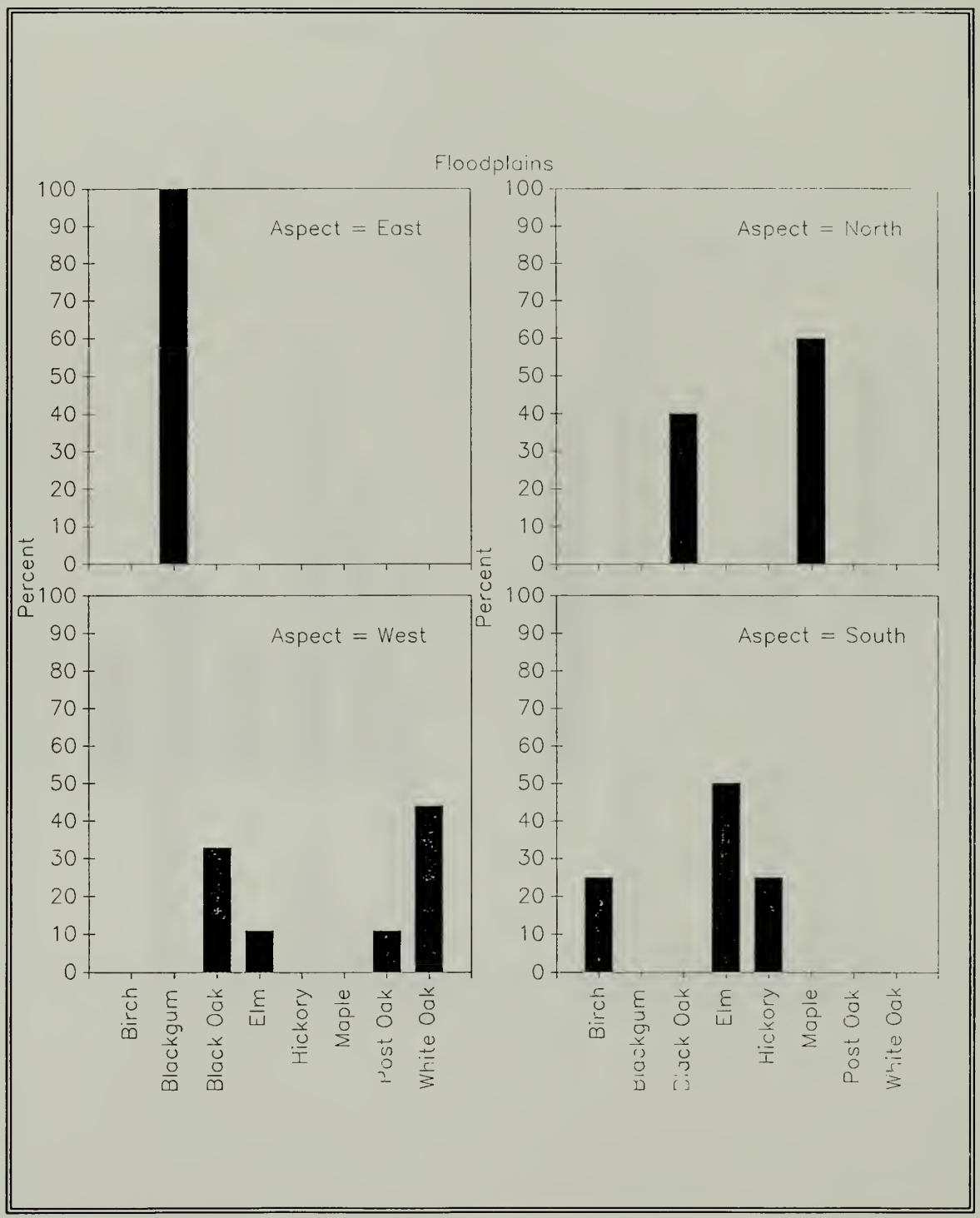


Figure 3-16. Tree distribution by aspect class for trees located on the floodplains.

The lower steep slopes on the Salem Plateau and showed a significant difference in proportions of tree species with a p-value = .009. The eastern and northern exposure was dominated by Black Oak and White Oak, respectively, while the western and southern exposures were codominated by Pine and Post Oaks.

The lower rolling slopes showed no significant differences due to aspect with a p-value = .451. Black Oak dominated all four aspects with codomination achieved by White Oak on the western aspect and Pine on the southern aspect.

Old stream terraces showed no significant differences in aspect but only had a total of eight trees sampled in the area on two aspects.

The floodplain area had a significant different proportion of tree species with a p-value = .002. The number of samples are few (19) which again may not give a clear picture. White Oak dominated in the western exposure, Maple in the northern, Elm in the southern, and Blackgum in the northern exposure.

Using the proportion of tree species that were found in each aspect at a given location with the results from the statistical analyses, a map was produced indicating likely locations for tree communities. The map was produced by using the GRASS module Ginfer. This module is an inference engine which uses boolean logic to relate map layers to produce a new composite map. For this project, combinations of the data layers aspect and relative location were used to indicate likely locations for the various tree communities identified from the statistical analyses. These locations are summarized in Table 3-14 and shown in Figure 3-17.

Table 3-14. Likely locations for various tree communities.

cat #	Name	% no cat 0	hectares
0	No data	0.00	1,573.20
1	Black Oak dominant	27.41	3,133.98
2	White Oak dominant	20.83	2,381.94
3	Black Oak/White Oak codominant	4.19	478.89
4	Oak/Pine codominant	34.12	3,901.41
5	Pine dominant	8.03	918.63
6	Cedar	1.43	163.98
7	Mixed Hardwoods	2.03	232.38
8	Floodplain	1.96	223.83
	Totals	100.00	13,008.24

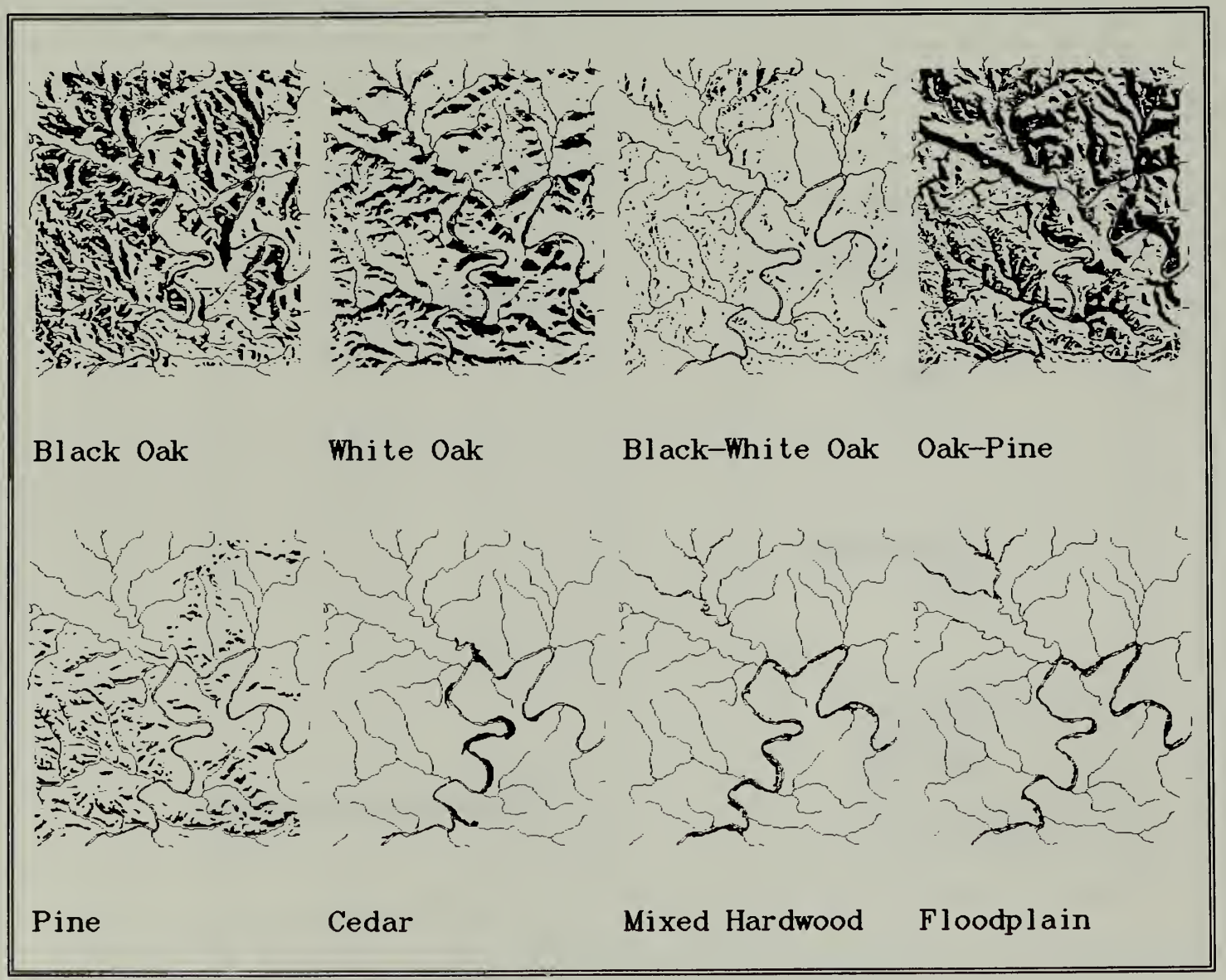


Figure 3-17. Presettlement vegetation reconstruction.

In summary, with the data set available for the 120 square km area encompassing the Rush site, a number of environmental factors appear to be important to the location of individual tree species and tree communities. The environmental factors investigated were soils (levels of soil classification), slope, aspect, and relative location with respect to parent material and topography. Within this study area, slope could not be shown to be an important consideration in tree species location. The variables soils and relative location for the areas containing samples were reflective of each other, therefore, relative location was used to produce the final results. Both aspect and relative location were significantly related to the distribution of tree species. Relative location showed the importance of parent material in the landscape while aspect reflected the difference in moisture requirements by the differing proportions of particular tree species. These two environmental variables, which reflect tree species occurrence, allowed the production of a final composite map showing the general presettlement vegetation of the Rush area.

The Immediate Site Environment of 3MR80

Using the GIS data layers, we can also characterize the immediate environment around the Rush site. Using these data, we can characterize the site as located at 453 feet on a northwest facing slope of 2 degrees. The vegetation is Oak-Pine and the soil is the Estate-Portia-Moko association, rolling, which is classed as marginal in its agricultural potential. Finally, the site falls within the 0 to 90 m distance to stream class. We can also use these data not only to look at the immediate "center" of the site, but also at its neighborhood. Using an area 150x150 m centered on the site, we have a neighborhood of 25 cells each 30x30 m. Table 3-15 is a GRASS printout which characterizes this neighborhood. The elevation values are in meters and each cell on the table reflects each 30 m cell in the database.

Table 3-15. Immediate site environment.

```
Layer:  rush.elev
    1     cell in cat 141
    1     cell in cat 143
    2     cells in cat 144
    1     cell in cat 146
    3     cells in cat 148
    2     cells in cat 149
    3     cells in cat 150
    2     cells in cat 151
    4     cells in cat 153
    1     cell in cat 154
    3     cells in cat 156
    1     cell in cat 158
    1     cell in cat 159
```

Figure 3-15. Continued.

Layer: slope		
8	cells in cat 1	0 degrees
7	cells in cat 3	2 degrees
6	cells in cat 7	6 degrees
2	cells in cat 9	8 degrees
2	cells in cat 13	12 degrees
Layer: aspect		
4	cells in cat 1	east facing
1	cell in cat 4	northeast facing
9	cells in cat 10	northwest facing
8	cells in cat 11	30 degrees north of west
3	cells in cat 25	no aspect
Layer: rveg--Buffalo River vegetation		
6	cells in cat 3	D Disturbed areas
19	cells in cat 7	OP Oak-Pine
Layer: Rsoils3--reclass of rsoils2		
24	cells in cat 4	Estate-Portia-Moko Assoc., rolling
1	cell in cat 5	Wideman sandy loam, frequently flooded
Layer: rsoils.agri--reclass of resoils2		
25	cells in cat 3	marginal
Layer: pitkin.dist--proximity analysis		
25	cells in cat 37	15,000.00 to 16,250.00 meters
Layer: boone, distance--proximity analysis		
25	cells in cat 3	500.00 to 750.00 meters
Layer: cotton. distanc--proximity analysis		
25	cells in cat 32	8,750.00 to 10,000.00 meters
Layer: streams.dist--proximity analysis		
3	cells in cat 0	locations from which distances calculated
19	cells in cat 1	0.00 to 90.00 meters
3	cells in cat 2	90.00 to 180.00 meters

In the preceding discussions, we have presented basic information in the biophysical environment of the Rush locality. In later chapters, we will consider these environmental characteristics in the context of the differential use of the landscape by the Dirst site's prehistoric inhabitants.

CHAPTER 4

Field and Laboratory Methods

GEORGE SABO III

The central concern of the Rush project was the excavation of 3MR80-Area D, an archeological site that occupies a triangularly shaped segment of a high terrace (measuring about 75 m on a side) adjacent to Rush Creek, just a short distance north of its confluence with the Buffalo River (Fig. 4-1). The SPEARS archeological consulting firm tested the area containing this site in 1986. Two short backhoe trenches were excavated near the edge of the terrace and a series of floodplain overbank deposits were excavated containing artifacts to a depth of approximately 2 m below the surface. A thick (30 - 60 cm) midden containing numerous artifacts, bone, shell, and charcoal was also identified just below the surface, blanketed by 15 - 20 cm of sand deposited by a flood in 1982.

Fieldwork by the Arkansas Archeological Survey was conducted during 35 working days between October 17 and December 1, 1988. A brief summary of the tasks completed and field methods employed during this period is given below. This is followed by a description of the procedures employed in the laboratory processing of the excavated collections, along with a brief identification of material analyses undertaken as part of this project.

Field Methods

A grid system was established on 3MR80-Area D, oriented to the angle of the confluence of Rush Creek and the Buffalo River (Figure 4-2). Shovel testing was conducted across Area D on a 10 m grid to determine the depth of the 1982 flood sands across the site and to ascertain the extent of the midden (Figure 4-3). Additional shovel tests and 50x50 cm column samples (excavated in 10 cm levels) were excavated to the west of Area D to determine the extent of archeological materials in that direction. Sediments excavated in all shovel tests and column samples were dry screened through 0.64 cm mesh, and profile drawings were made of the north wall of each column sample prior to backfilling. A 1:100 scale topographic map of Area D was produced using a 25 cm contour interval, and the vertical datum for this mapping was tied in to a National Park Service benchmark (RC-1, 488.24 feet above mean sea level) located behind the "comfort station" on the opposite side of Rush Creek.

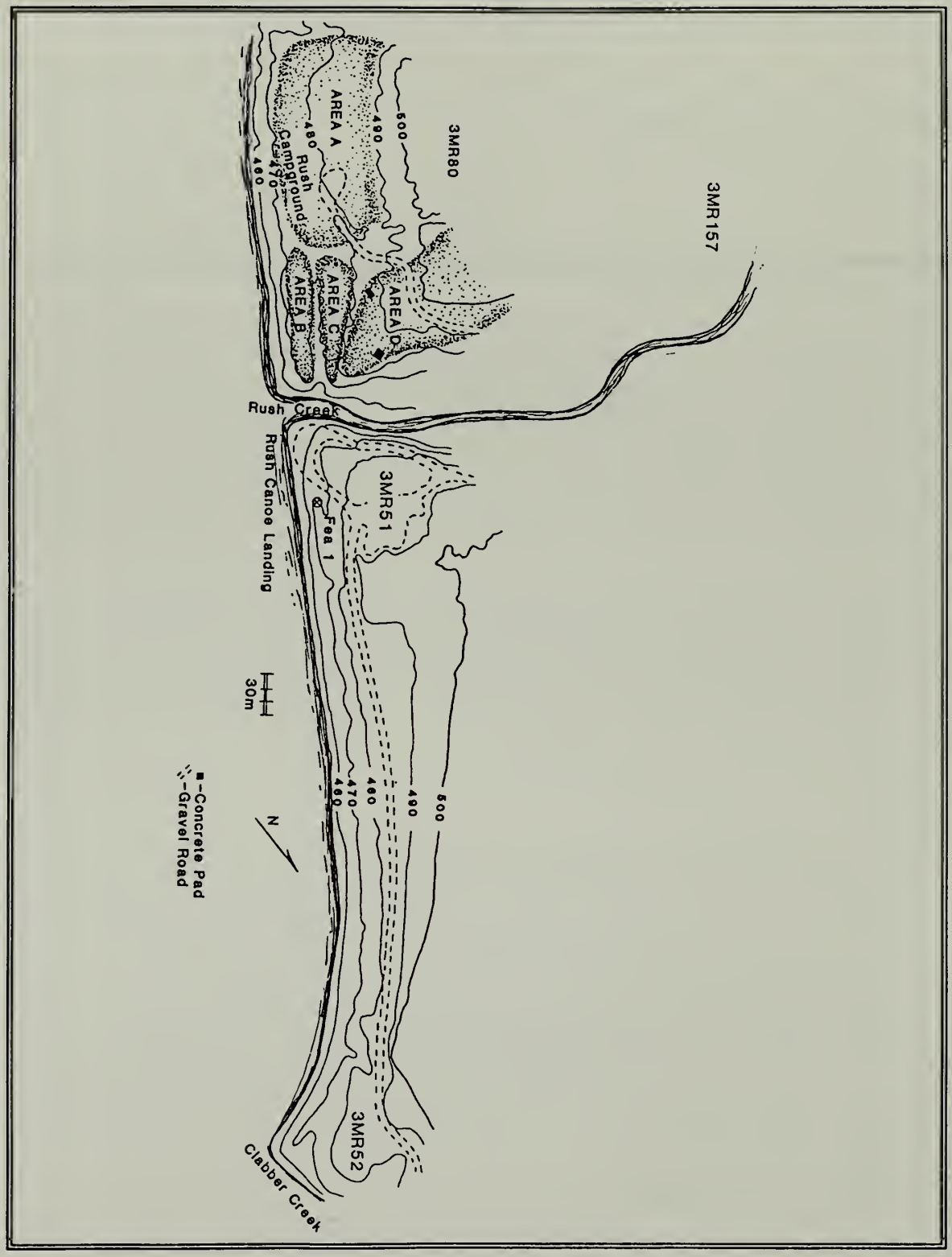


Figure 4-1. Archeological sites in the Rush Development Area.

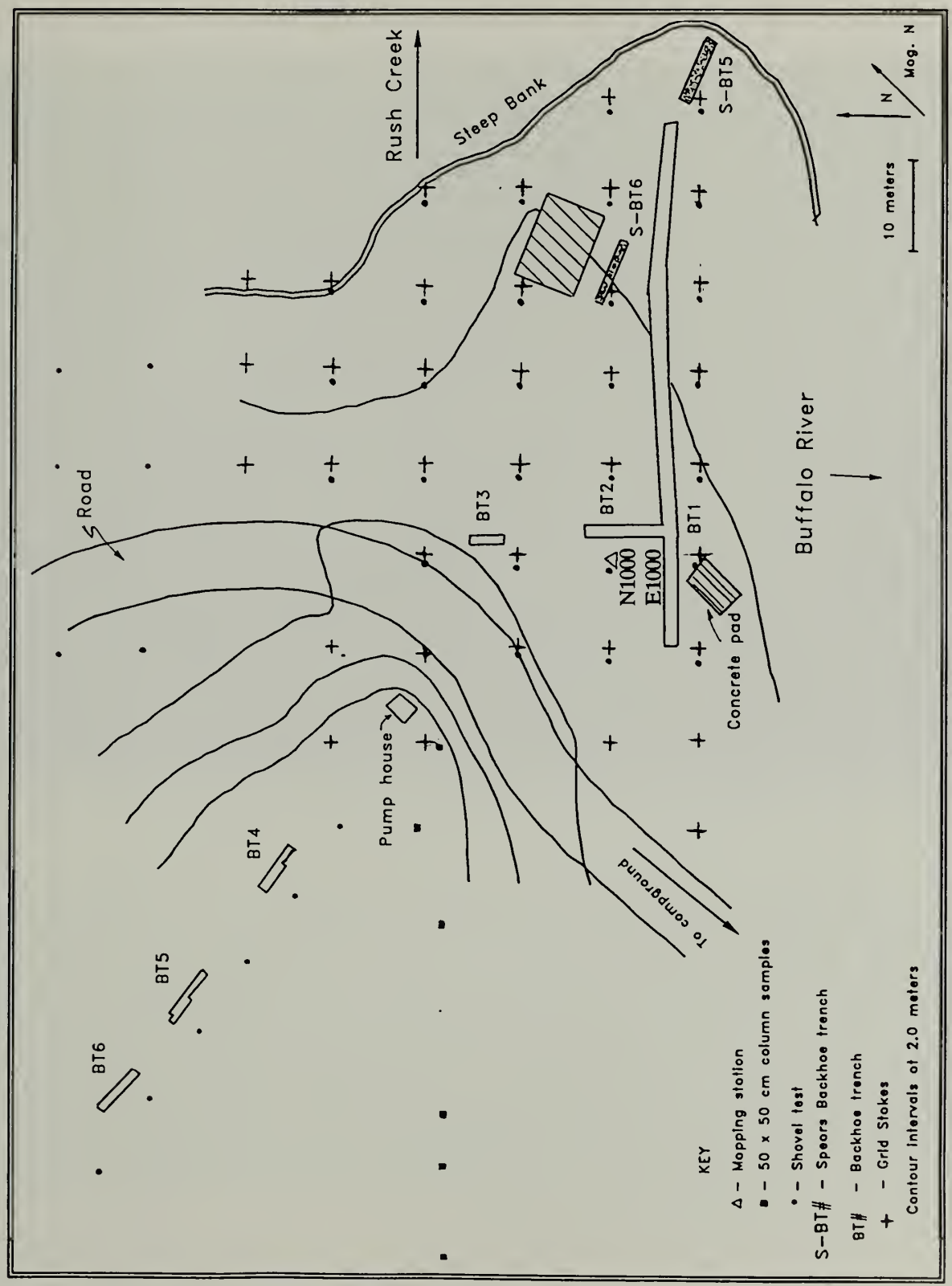


Figure 4-2. Grid system, shovel tests, column samples, and backhoe trench placement in 3MR80-Area D.



Figure 4-3. Excavation of shovel tests across Area D (AAS Neg. #885853).

One 60 m backhoe trench (BT1) was excavated perpendicular to Rush Creek along the southern edge of Area D, and two shorter backhoe trenches (BT2 and BT3) were excavated perpendicular to the main trench (Figure 4-4). The backhoe trenching was carefully monitored, and at one point, machine excavations in Backhoe Trench 1 were halted in order to hand excavate a shallow pit feature (Feature 1) that was uncovered in the midden layer. A standard volume sample (20 liters) of the midden sediment was dry screened through 0.64 cm mesh at 5 m intervals along Backhoe Trench 1, and grab samples of artifacts were collected and bagged according to midden or submidden provenience, and by 10 m intervals along the trench. Several artifacts were also retrieved by hand from buried sediments during the backhoe trenching operations. The south wall of Backhoe Trench 1 and the east walls of Backhoe Trenches 2 and 3 were cleaned and photographed, with extensive notes being recorded of the exposed stratification. Detailed profile drawings at a 1:20 scale were made of the prepared walls in each backhoe trench.



Figure 4-4. Backhoe trenching in Area D (AAS Neg. #885854).

Placement of 2x2 m test units across Area D was determined on the basis of the backhoe trench stratigraphy and shovel testing results, the surface topography of the site, the distribution of large trees, clumps of impenetrable vegetation, and other barriers such as concrete slab building foundations. A goal of these excavations--within the limits of available time and personnel--was to collect a sample of materials from suspected buried cultural deposits that would permit identification of discrete activity areas (cf. Brown 1975). In general, we attempted to place one test unit within each 10 m block of our grid system, in the hope that this would maximize our chances of intercepting discrete feature complexes that might exist at the base of the midden. These initial test units are called Phase I units. Each unit was excavated in 10 cm levels within natural/cultural stratigraphic boundaries until a buried living surface or feature complex was encountered, or until culturally

sterile deposits were reached (Figure 4-5). When buried living surfaces or feature complexes were encountered, adjacent 2x2 m units were opened to more fully expose the horizontal extent. The excavation of buried living surfaces and feature complexes, as well as the excavation of deposits below the midden in all units, represented Phase II of our digging strategy. Living surfaces and selected feature complexes were excavated in 5 cm levels, and by 50x50 cm grids within 2x2 m units for tighter provenience control. The sediments from all Phase I and II excavation units were dry sifted through 0.64 cm mesh screens. Standard samples (generally 50x50x10 cm) were collected for each excavation level at the southwestern corner of each 2x2 m excavation unit for water flotation processing, and all excavated feature fill was also processed by water flotation. Excavation unit level sheets containing notes, field specimen numbers, plan drawings, and other information were completed on a daily basis as the digging proceeded in each unit. Profile drawings and photographs were made of the south and west walls of each completed excavation unit, and other photographs were taken as needed to document significant information.



Figure 4-5. Excavation of 2x2 m test unit in Area D (AAS Neg. #885824).

Dr. Margaret B. Guccione, geomorphology consultant from the University of Arkansas, visited the site with her assistants in early November. The geomorphology team examined the three previously excavated backhoe trenches, and with the backhoe operator they deepened Backhoe Trenches 2 and 3 and excavated three more short trenches (BT4 - BT6) into the upper terrace zone to the west of Area D. Excavation of Backhoe Trench 4 intersected a previously undetected midden area (hereinafter described as the "upper midden") and a very large pit feature extending from the base of the midden into the underlying sediments. Sediment samples were extracted for composition and particle size analysis from several of the backhoe trenches as well as from three cutbank profiles: two along the Buffalo River and one along the gully that forms the southern boundary of Area D (Figure 4-6). Profile drawings of the southern walls of Backhoe Trenches 4, 5, and 6 at a scale of 1:20 were made by the archeology team. On the basis of these investigations a preliminary interpretation of the geological context of Area D was made.



Figure 4-6. Sediment sample extraction from geomorphology cutbank profile (AAS Neg. #886251).

In all, seventeen 2x2 m test units were excavated in Area D during the project. Additionally, one smaller, 50x50 cm test unit was excavated in the upper midden area intersected by Backhoe Trench 4. The accompanying pit fill (Feature 8) was taken out as a flotation sample. A final series of shovel tests on a 10 m grid was excavated to the north of Area D to trace the distribution of artifacts in that direction.

Finally, test excavations were conducted at 3MR51, Feature 1, on the eastern side of Rush Creek directly across from 3MR80. SPEARS had previously noticed burned clay and limestone slabs eroding out of the tip of a detached terrace remnant about a meter below the surface. A profile face was cut along the eroding terrace edge at the location marked by SPEARS. Burned clay fragments and small limestone slabs were noted in a secondary depositional context. To determine if an intact burned feature existed further into the terrace, a 1x1 m test unit was excavated to a depth of 1.56 m below the surface immediately behind the cut bank profile. No burned feature was encountered. A report on this investigation and an assessment of 3MR51, Feature 1, is provided in Appendix 2 of this report.

Laboratory Processing Procedures

All archeological samples collected in the field were assigned numbers from a field specimen catalog (a computer printout of the complete field specimen catalog is reproduced as Appendix 4). The field specimen numbers (FSNs) were indicated on the appropriate excavation unit level sheets as well as on the inside and outside tags of each artifact bag. All finished artifact bags were checked against the field specimen catalog and discrepancies were corrected before the bags were sent to the lab. In the lab, bag tags were double-checked against the field specimen catalog, and then the contents of each bag were emptied onto a washing tray lined with a window screen. Charcoal and other delicate materials were removed from the screen by hand and placed in vials or plastic zip-lock bags with a tag containing the FSN number and were not washed. All chipped lithics and flakes were gently cleaned by light finger-scrubbing under water, as were ceramics and bone. Ground stone artifacts and other rock materials were cleaned by gentle scrubbing with soft-bristle toothbrushes.

After being washed, the materials were sorted by lab workers into the following categories: chipped stone artifacts, ground stone artifacts, flakes and chipping debris, fire-cracked rock, other broken rock, unmodified rock, ceramics, bone, shell, charcoal, historic artifacts, and "other." The historic artifacts were very few in number and nearly all were collected from disturbed contexts at or just below the present ground surface. All but a few fragments of solarized glass could be attributed to the canoe rental facility operated on the site during the late 1960s and early 1970s by the late Fred Dirst. Since these artifacts have no significant bearing on the archeological structure or prehistoric cultural history of Area D, they will not be discussed further. All of the historic artifacts collected and their proveniences are indicated in the artifact appendices.

Chipped stone artifacts were placed individually in plastic zip-lock bags. Flakes were size-graded (using screens with 5.08 cm, 3.81 cm, 2.54 cm, 1.27 cm, and 0.64 cm mesh sizes) before they were bagged. Counts and weights of all size grades 1.27 cm and larger were recorded; weights only of 0.64 cm size grades were recorded.

Fire-cracked rock and other broken rock was also size-graded, separated by raw material type, and weighed. After these data were recorded, fire-cracked rock from general excavation levels was discarded. Fire-cracked rock from intact living surfaces was saved. Unmodified rock was discarded immediately unless it could be classified as unmodified raw material for stone artifact manufacture (i.e., chert pebbles, cobbles, or chunks retained in the 2.54 cm or larger size grades). All other artifact categories (ceramics, bone, shell, etc.) were individually bagged. The project accession number and individual FSNs were written in indelible ink on all chipped and ground stone artifacts, unmodified raw material, flakes, and chipping debris (in the size grades greater than 1.27 cm), and on all ceramics at least 1.27 cm across. A tag containing both the accession number and FSN number was also placed in each artifact bag. All artifact bags from a single provenience unit were then placed in a single cardboard "inside box" with the exception of those containing chipped stone artifacts, which were placed in separate inside boxes. Several inside boxes were then placed according to FSN in "outside boxes," i.e., heavier, covered cardboard trays.

Classification and Analysis

The entire collection of processed materials was examined by the Principal Investigator and all preliminary sorting errors that were noted were rectified. Several sub-samples of the total artifact collection were then resorted by the Principal Investigator according to more detailed classification schemes to provide the necessary data sets for a number of specific analyses. The Arkansas Archeological Survey's computerized artifact classification system (DELOS) was employed for this purpose. As artifact samples were reclassified, inventory data were recorded onto DELOS coding forms and entered into a data base maintained in the Survey's CONCURRENT 6300 computer. All artifact data base manipulations and the production of summary tabulations were performed by the CONCURRENT 6300 computer. The following is a summary of classification schemes employed to provide data sets for the artifact analyses presented in subsequent chapters of this report.

1) For all proveniences, chipped and ground stone artifacts were classified according to morpho-functional categories (i.e., shape and common use), and additional observations and measurements were recorded for each piece (Tables 4-1 and 4-2). It should be noted here that morpho-functional categories employed in DELOS classification are based on the morphological properties of artifacts (i.e., their shape), and do not imply independent determination of every function these artifacts may have actually served when they were used by prehistoric people. If an artifact is classified as a "dart point," for example, it is because the artifact possesses the characteristic shape of such an implement. It may in fact have been used for other purposes, but only highly specialized microscopic examination of use-wear traces on the artifact would permit a more conclusive determination of its function. Functional classifications based on morphological characteristics alone, such as the one employed in this report (as well as similar versions commonly used by archeologists) are therefore best taken as plausible hypotheses that should be further tested.

Table 4-1. Artifact classification for 3MR80-Area D.

Artifact Category	DELOS Acronym
Chipped Stone Artifacts	
Arrow	ARROW
Dart	DART
Knife	KNIFE
Other biface tool	BIFK
Hafted biface tool	HBIFK
End scraper	END
Side scraper	SIDE
Side and end scraper	SIND
Thumbnail scraper	THUMB
Spokeshave	SPOKS
Denticulate scraper	DENSCR
Other scraper	SCR
Drill	DRILL
Drill/Awl	DRAWL
Perforator/Graver	PERG
Graver	GRAV
Core tool	CORETO
Arrow Preform	ARRPFM
Dart Preform	DARPFM
Other Preform	PREFRM
Tabular core	TABC
Shaped core	SHAP
Unprepared core	UNPREP
Tested Pebble	TP
Tested Cobble	TC
Burin spall	SPALL
Hammer	HAM
Adze	ADZE
Axe	AXE
Celt	CELT
Unmodified Raw Material	URM
Ground Stone Artifacts	
Mano	MANO
Pitted stone	PITS
Polished stone	POLSTN
Paint stone	PAINT
Cobble	COBL
Cobble tool	COBTO
Ceramics	
Sherd (less than 0.64 cm)	SHERD
Rim sherd	RIM
Body sherd	BODY
Base sherd	BASE

Table 4-2. Attributes encoded for artifacts from 3MR80-Area D.

- Field Serial Number (FSN)
- Lab Serial Number (LSN)
- Artifact Serial Number (ASN)
- Artifact Category
 - General Artifact Category
 - CL = Chipped Lithic
 - GRL = Ground Lithic
 - POT = Ceramic
 - Specific Artifact Category (see Table 4-1)
- Raw Material
 - LBOONE = light Boone chert
 - GBOONE = gray Boone chert
 - BBOONE = blue Boone chert
 - STJOEG = green St. Joe chert
 - STJOEJ = jasper St. Joe chert
 - REEDSB = brown Reeds Spring chert
 - REEDSG = gray/green Reeds Spring chert
 - PITKIN = Pitkin chert
 - COTTER = Cotter chert
 - JEFCIT = Jefferson City chert
 - NOV = Novaculite
 - QZIT = Quartzite
 - QXL = Quartz Crystal
 - CALXL = Calcite Crystal
 - SS = Sandstone
 - LS = Limestone
- Weight (for cores and unmodified raw material only)
- Whole or Fragment
 - Type of Fragment (proximal, medial, distal)
- Presence/Absence Heat Treatment for Chipped Lithics
- Presence/Absence Cortex for Chipped Lithics
- Type/Variety
- Measurement
 - Length/Width/Thickness for Chipped and Ground Lithics
 - Size Grade for Cores (5.08, 3.81, 2.54, 1.27, 0.64 cm)
 - Thickness for ceramic sherds
- Other Qualifiers
 - Haft element and shape for chipped lithics
 - Temper for ceramics
 - BOSH = bone and shell
 - GROBON = grog and bone
 - GROG = grog
 - GROSH = grog and shell
 - SHELL = shell

2) Ceramics were classified according to temper and vessel part (rim, body, base), and additional observations were recorded concerning the decoration and thickness for each sherd (Table 4-2).

3) Unmodified raw material was counted and weighed by size grade.

4) Flakes and chipping debris ("debitage") were treated according to one or the other of two classification schemes, depending upon provenience, as described below:

Shovel tests and 50x50 cm column samples. Flakes and chipping debris in these proveniences were sorted according to the simplified, generic classification seen in Table 4-3, which we considered sufficient for the purposes of these test excavations that were designed to delimit the extent of the midden within Area D and to determine its boundaries.

Table 4-3. Generic classification for chipped stone debitage.

Category	DELOS Acronym
Flake/Debitage	F/D
1. Sorted by size grade (5.08, 3.81, 2.54, 1.27, 0.64 cm) 2. Weight recorded for all size grades 3. Counts recorded for all size grades except 0.64 cm	

Midden area test units south of Backhoe Trench 1. For midden area test units on the south side of Backhoe Trench 1 (N990/E1010, N990/E1018, N990/E1020, N990/E1026, N990/E1028, and N990/E1040), the generic classification (flakes and chipping debris) mentioned above was also employed. The large quantity of debitage collected during our excavations precluded a detailed analysis of the entire assemblage in light of the amount of time and money available for the analysis phase of this project.

Midden area test units north of Backhoe Trench 1. A decision was made to employ a more detailed classification for analysis on a sample from the midden component and underlying strata. A 4x4 m block of excavation units to the north of Backhoe Trench 1 (N1003/E1020, N1003/E1022, N1005/E1020, N1005/E1022) and all features of aboriginal origin were selected for this more detailed chipped stone debitage classification and analysis. The debitage from N998/E995 was also included in this sample. In addition to the fact that this sample represents approximately 50 percent of all of the flakes and chipping debris collected from test units excavated in the midden area, one of the 2x2 m units, N1003/E1020, was also excavated to the lowest artifact-bearing sediment, Stratum 1B. This provided a sample of chipped stone debitage representing all cultural components identified beneath the midden. Unfortunately, the debitage samples from Stratum 2 and Stratum 1b turned out to be too small to provide comparative results. For this sample, the expanded classification of flakes and

debitage employed for this sample incorporates breakdowns by flake type, raw material type, and size grade (Table 4-4).

Table 4-4. Expanded classification for chipped stone debitage.

Category	DELOS Acronym
Unmodified flake	FLA
Modified flake	RUM
Shatter	SHAT

1. Each category sorted by size grade
2. Each category and size sorted by raw material type
3. Weights recorded for all sorted groups
4. Counts recorded for all sorted groups except 0.64 cm size grade

Artifact collections from other provenience lots were inventoried but not further analyzed. These include standard interval volumetric samples of the midden collected during the excavation of Backhoe Trench 1, grab samples collected from all backhoe trenches, and artifacts from test units in the non-midden portion of Area D (except N998/E995). In the case of the backhoe trench samples, there were no items in any of these collections that were not duplicated in kind or in quantity in the collections derived from the test units, the latter of which represent the superior data set for analytic purposes. It should also be noted that these samples were important primarily as they were collected and examined during the field phase of the project, when they provided an immediate indication of the cultural components represented at the site, as well as a preview of the kinds of materials that would be encountered in the controlled excavations. As discussed in Chapter 5, the profiles in all of the test units excavated in the non-midden portion of the site revealed disturbed and/or eroded sediments. Although an appreciable quantity of artifacts was recovered from these units, none can be confidently associated with any discrete cultural component. Apart from the brief discussion of these materials that is given in Chapter 6, they are not included in any of the analyses presented hereafter. Appendix 4 presents basic inventory data on the collections from all of the above-mentioned proveniences.

Artifact and Other Material Analyses

Several preliminary, and very basic, analyses were undertaken using the various data sets identified in the preceding discussion. A brief description of these analyses is presented below. In general, these analyses centered on issues related to the most pressing management or research concerns. By no means do the interpretations derived from these analyses represent a final assessment of the site. Initially, it was hoped that some analyses of the spatial distribution of artifacts could be performed on materials collected from various components to permit identification of discrete activity areas, but, unfortunately, for no component was a sufficient area of excavations opened up to provide the necessary data. However, the quantities of artifacts in

several strata were sufficient to permit reconstruction of activity profiles based on functional assessments of the artifact assemblages.

1) Assemblage Characterization by Component. The first analytic exercise consisted of an assessment of the horizontal and vertical distribution of chronologically sensitive artifacts--primarily projectile points and ceramics--to identify discrete cultural components and determine stratigraphic relationships. As each component was identified, the associated material assemblage was derived from the inventory data from controlled excavation contexts. Chapter 5 presents the results of this analysis.

2) Functional Assessment of Artifact Assemblages by Component. As noted above, finished artifacts and identifiable fragments were classified into functional categories based on morphological (shape) attributes. The distribution of artifacts within these functional categories was used to reconstruct an activity profile for each identified component. These activity profiles are presented in Chapters 9 and 10, where they are considered in light of other data associated with each component.

3) Ceramic Attribute Analysis. A large number of ceramic sherds were collected during our excavations, but most are undecorated and do not lend themselves to a detailed characterization of types and varieties. A rudimentary assessment of temper, rim shape and configuration, and sherd thickness attributes was undertaken. Since this is one of the first sizable sherd assemblages reported for an open habitation site in the Ozarks, the major concern of the present analysis is comparison in Chapter 13 with contemporary ceramic assemblages documented in adjacent regions.

4) Stone Tool-Making Technology. The sample of chipped stone artifacts and debitage from the 4x4 m block excavation to the north of Backhoe Trench 1 was examined to reconstruct processual models of the subtractive technologies employed to produce stone tools in the Stratum 3, 4, and 5 components at 3MR80-Area D. The approach employed for this analysis was developed by Marvin Kay in an analysis of artifacts from the Cedar Grove site (Kay 1984), a late prehistoric Caddo habitation in southwest Arkansas. This analysis is described in Chapter 9, and its results are presented in Chapters 9 and 10.

5) Stone Resource Utilization. The same sample of chipped stone materials from the 4x4 m block excavation was also employed in an examination of the utilization of chert resources from identifiable bedrock sources, using the Arkansas geological base map and other data layers and analytic routines available in the Survey's computerized Geographical Information System. This analysis is presented in Chapter 12.

6) Other Analyses. Dr. Margaret Guccione of the University of Arkansas conducted a geomorphological analysis of the immediate terrace area of 3MR80-Area D. Her analysis and Randall Guendling's assessment of the archeological stratigraphy is presented in Chapter 5. Floral and faunal specimens collected from features and excavation units within the lower midden zone of the site were sent to specialists for identification and interpretation. Dr. Gayle J. Fritz of the University of Michigan Museum of Anthropology performed the analysis of floral remains with the assistance of Ms. Sandra L. Dunavan.

Ms. Susan L. Scott of Scott and Associates, Hattiesburg, Mississippi, performed the analysis of faunal remains. The floral and faunal analyses are presented in Chapter 7 and 8. Three samples of carbonized plant material were also submitted to Beta Analytic, Inc. of Coral Gables, Florida, for radiocarbon dating. The assay results are discussed in Chapter 6. Finally, a series of analyses examining the location of 3MR80 within a variety of cultural contexts and environmental parameters was performed by Dr. W. Fredrick Limp, Mr. Jami J. Lockhart, and Ms. Pamela Smith, all of the Arkansas Archeological Survey. Using the Survey's computerized Geographical Information System, their analyses characterized environmental parameters, prehistoric land use patterns, and prehistoric cultural landscapes for the Rush locality.

Collection Curation

The material collections from the Rush project have been sorted into analytic categories by provenience and major material type including lithics, ceramics, animal bone, carbonized plant remains separated from flotation light fractions, and human skeletal fragments. Additional categories which have been sorted but were not analyzed are miscellaneous soil samples, flotation heavy fractions, and mussel and snail shells. These materials are presently contained in 60 standard storage boxes. All collections, including artifacts, maps, specimens, samples, notes, photographs, computer data files, and other documentation are curated with the Arkansas Archeological Survey in Fayetteville in accordance with the curation agreement in effect with the National Park Service (Subagreement 2 to Cooperative Agreement Number 7029-8-0007). All artifacts, samples, and storage containers are labeled with an accession number determined by the Office of the State Archeologist and in accordance to the Curation Standards put forth in Appendix J of the State Plan for the Conservation of Archeological Resources in Arkansas (Davis 1982; revised 1989).

Late Quaternary History of the Buffalo River, Rush, Arkansas

MARGARET J. GUCCIONE

RANDALL L. GUENDLING

Study Area

The study area is located near the southern margin of the North American craton. A thin succession of shallow water Paleozoic carbonate, shale, and sandstone cover Precambrian igneous and metamorphic rocks. Deformation of these strata is slight: the rocks dip at low angles to the southwest away from the Ozark Dome in southeastern Missouri and a few normal faults, which formed as the Arkoma foreland basin developed to the south, are generally oriented east-west.

On the basis of physiography the study area is located in the Ozark Plateaus Province (Figure 5-1) (Thornbury 1965). This province includes an east-central domal uplift, the St. Francois Mountains in southeast Missouri, and three plateaus, all of which dip gently away from the dome. The Salem Plateau is underlain by Ordovician carbonate strata, the Springfield Plateau is underlain by Mississippian carbonate strata, and the Boston Mountain Plateau is underlain by Pennsylvanian sandstone and shale strata. These plateaus are separated by escarpments which face toward the St. Francois Mountains. The Eureka Springs Escarpment rises from the Salem Plateau to the Springfield Plateau and the Boston Mountain Escarpment rises from the Springfield Plateau to the Boston Mountain Plateau.

The Buffalo River deeply dissects all three plateau surfaces (Figure 5-2) and its channel is cutting into Ordovician strata throughout most of its course. The headwaters flow north across the Boston Mountain Plateau. At the Boston Mountain Escarpment the river makes a right angle bend and flows generally east across the Springfield and Salem plateaus to its confluence with the White River on the Salem Plateau. The study area is in the downstream section of the river, along an east-flowing stretch of the river. It is located on the Salem Plateau in a narrow reentrant of the Eureka Springs Escarpment. Here the channel is cutting into the Ordovician St. Peter Sandstone and the Everton Formation.

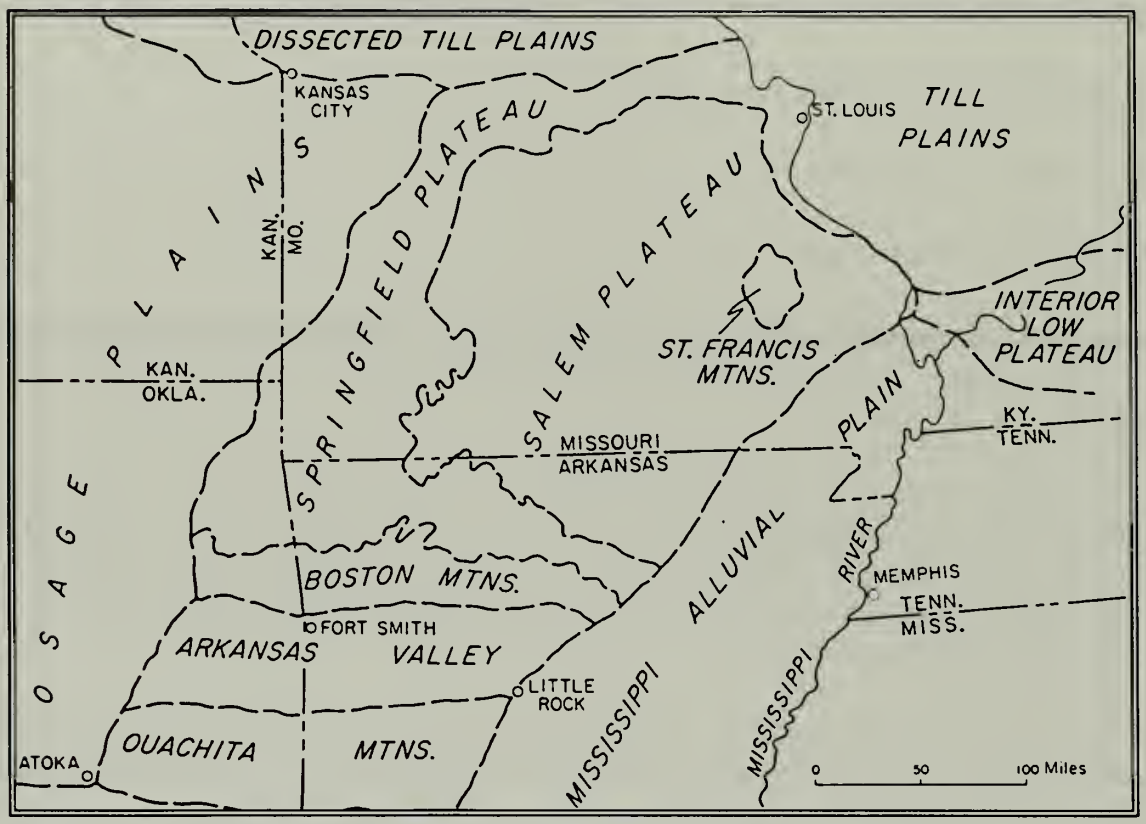


Figure 5-1. Physiographic provinces of the southcentral United States (from Thornbury 1967, Figure 14-1).

Methods

Six trenches and three exposures were examined (Figure 5-3). Four of the trenches and all of the exposures were described and sampled in detail (Appendix 9). Trench one was approximately parallel to the river. The other 5 trenches, the three exposures (Profiles 1, 2, and 4), and several short soil cores (Profile 3) were located in a transect approximately perpendicular to the river. This transect extended from the channel margin, across the floodplain and two terraces. The trenches were 1.6 to 2.5 m deep and the exposures are 2 to 3.8 m high. Soils and the sediments in which they are developed were described at seven sites in five trenches using standard U.S.D.A. format (Soil Survey Staff 1981). One hundred and fifteen samples were analyzed for grain size by dry sieving the gravel and the sand fractions and by pipette methods for the silt and clay fractions (Table 5-1) (Day 1965). Gravel is reported as a percent of the total sample. Sand is reported as a percent of the 0.002-2 mm fraction to eliminate the effect of pedogenesis as well as a percent of the <2 mm fraction to assess the effect of pedogenesis.

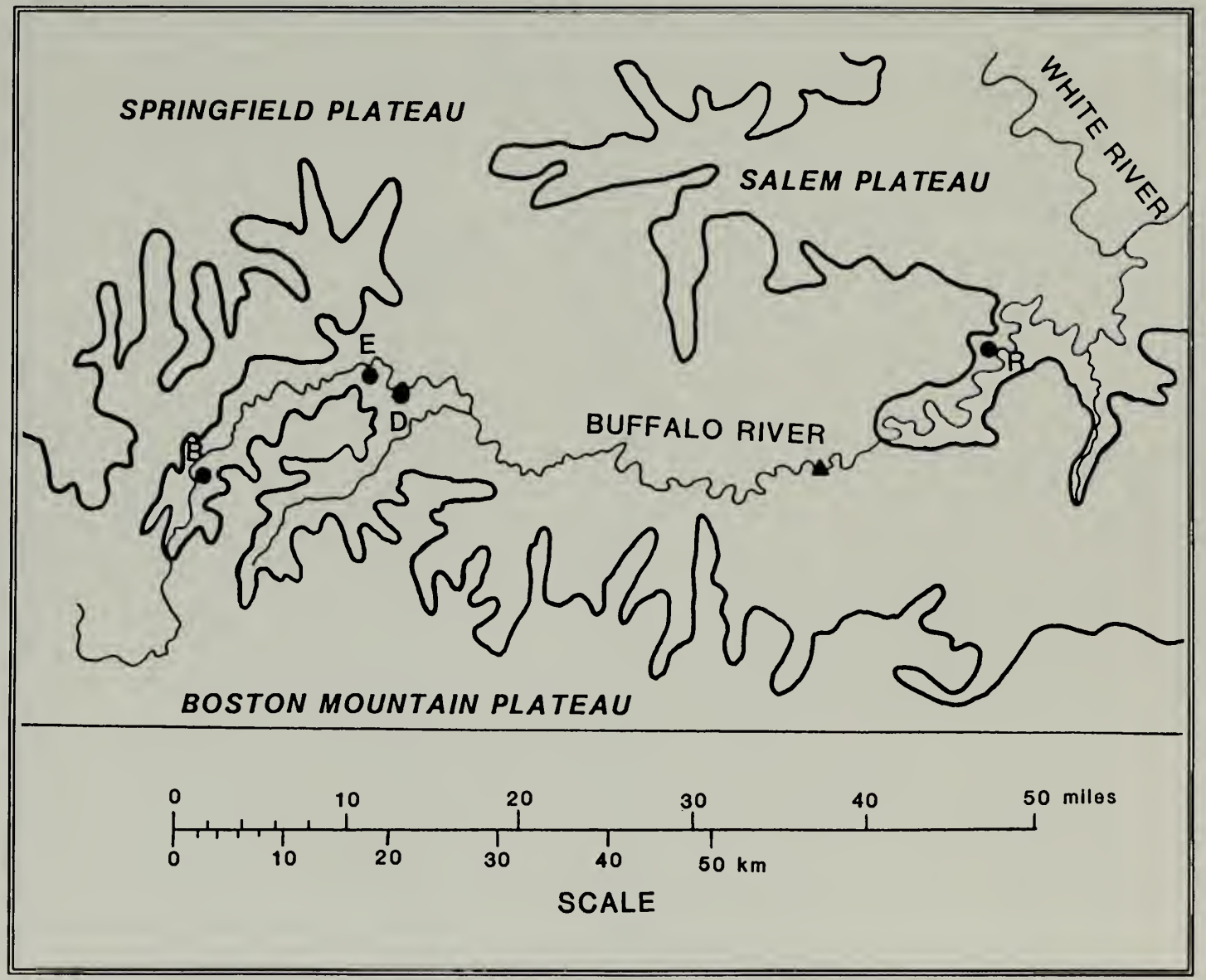


Figure 5-2. Map of the Buffalo River and the three physiographic plateaus in the region. B is Boxley, D is Dry Ford, E is Erbie, R is the Rush study area, and triangle is the stream gage at St. Joe, Arkansas.

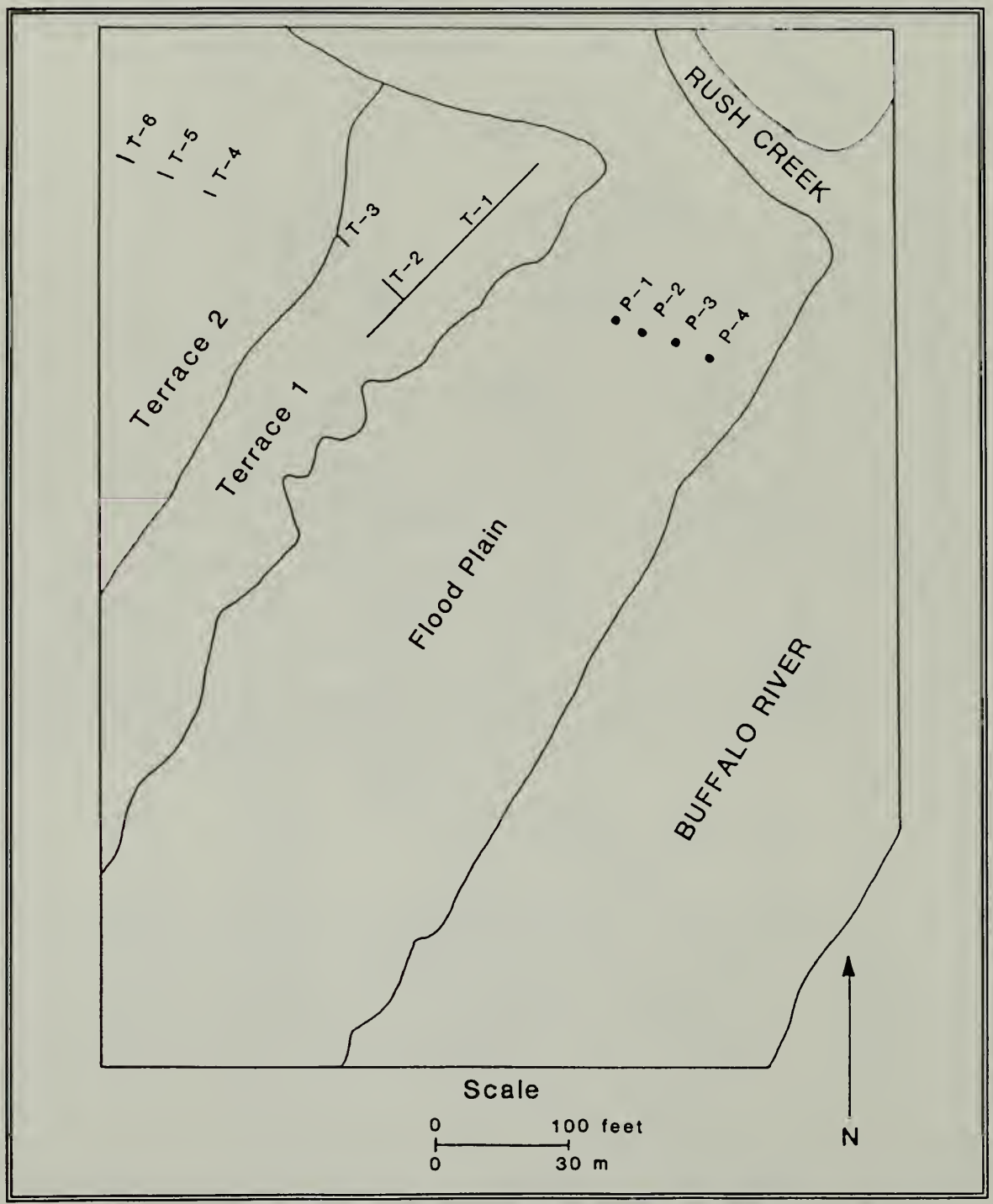


Figure 5-3. Map of study area showing the geomorphology of the area and the location of trenches (T-1, etc.) and profiles (P-1, etc.).

Table 5-1. Size fractions utilized in this study.

Fraction	Diameter (mm)		
Gravel	>2.0	-	1.0
Sand			
Very coarse	2.0	-	1.0
Coarse	1.0	-	0.5
Medium	0.5	-	0.25
Fine	0.25	-	0.125
Very fine	0.125	-	0.0625
Silt			
Fine	0.25	-	0.125
Very fine	0.125	-	0.0625
Clay			<0.002

Dates were estimated using archeological material. Maximum and minimum sedimentation rates were calculated for each interval between diagnostic artifacts. Organic material from the midden was submitted to Beta Analytic for radiocarbon analysis.

Geomorphology

The Buffalo River is a meandering river, deeply entrenched in Ordovician to Mississippian carbonate and sandstone bedrock. Local relief in the study area is up to 198 m (650 feet). The valley floor is narrow (0.3 km or 0.18 miles) but two terraces are preserved. Terrace 1 (t-1) occurs 4 m (13 feet) and Terrace 2 (t-2) occurs 8 m (26 feet) above the floodplain in the study area (Figure 5-4). The floodplain of this report is equivalent to the Floodplain and Low Terrace of Spears (1986) and Dixon (1986). Terrace 1 in this report is equivalent to the Old River Terrace of Spears (1986) and Dixon (1986). The site at which they described the sediment underlying this Old River Terrace (SPEARS Backhoe Trench 7) is probably erosional. It is approximately equivalent to the channel faces of either overbank 1 or 2 associated with t-1 (Figure 5-4) of this report. The landscape position, elevation, and weathering of the sediments clearly indicate that this landform and the sediment underlying it are younger than those of t-2 of this report.

Further upstream the number of terraces decreases. Near Erbie, Arkansas, the relief increases to 408 m (1,340 feet) and the valley width is approximately the same as near Rush, but only one terrace is present (Guccione 1988). This terrace is at the same elevation above the floodplain as the lower terrace at Rush. The

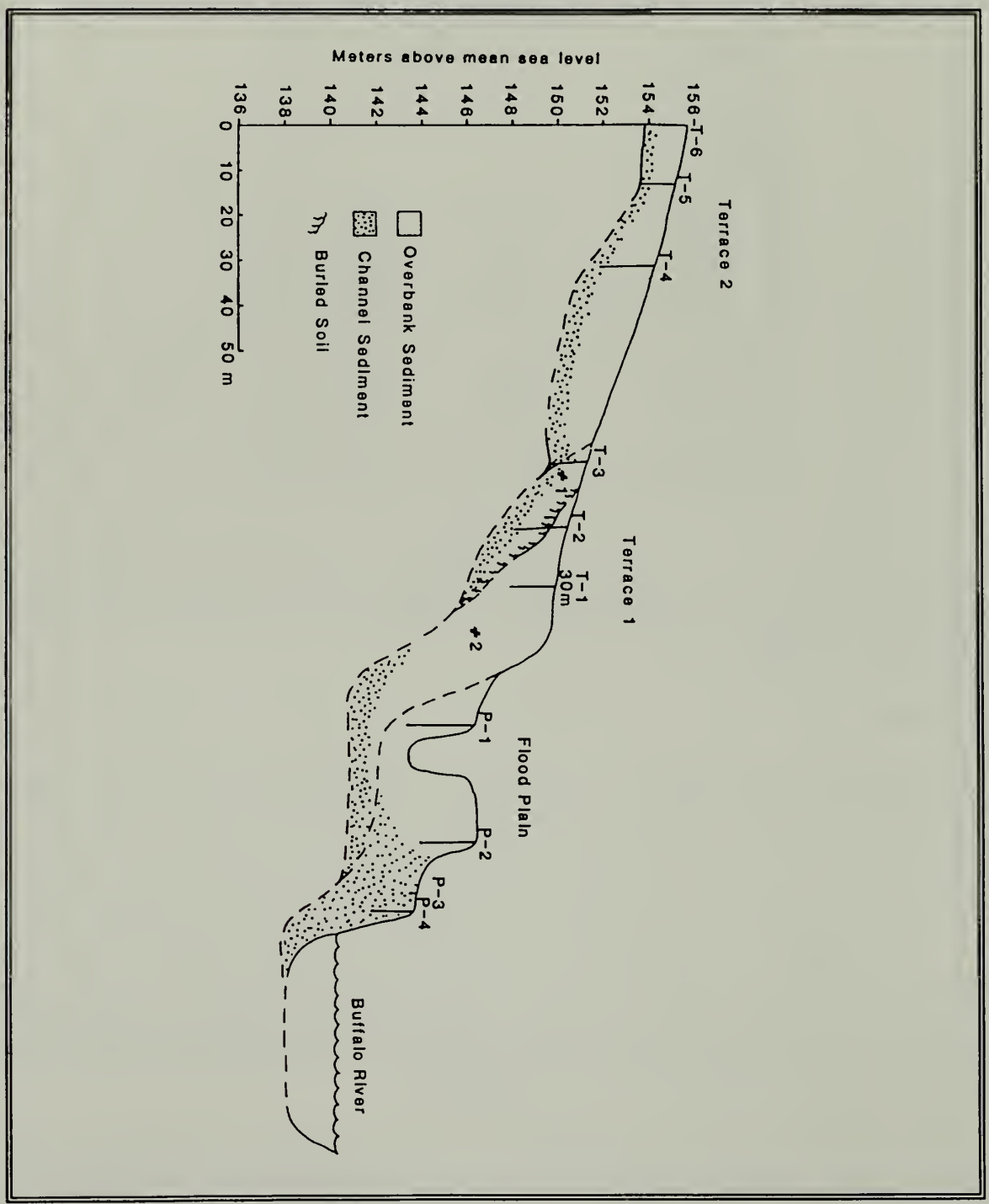


Figure 5-4. Cross section of Rush showing the landforms and the sediment that uderlies them. Location and depths of the trenches (T-1, etc.) and profiles (P-1, etc.) are shown. Numbers 1 and 2 are subdivisions of sediment that underlie Terrace 1.

upper reach of the Buffalo River near Boxley is a straight segment of the river. Here the valley is wider (0.7 km or 0.42 miles) than downstream, but no terraces are preserved in the main valley. A terrace is preserved in the tributary valleys (Guccione 1989).

Near Rush, Arkansas, the Buffalo River is a single, channel with sandy channel margins and sandy point bars. No prominent chute channels are present within the major channel or on the floodplain. Within the valley walls, the channel does not meander. This channel morphology is in contrast to that at Erbie and Boxley. At these two sites upstream of Rush, gravel is the dominant bedload of the river and gravel bars separate chute channels within the major channel and on the floodplain (Guccione, 1988 and 1989).

Sediment

Floodplain

Prehistoric Sediment

The sediment that underlies the modern floodplain and composes the present channel wall is dominantly sand. It can be subdivided into two major deposits, sandy channel and sandy loam overbank. The lower channel deposit, sampled in Profiles 3 and 4, is a well-sorted sediment that is 93 percent or more sand with a mode in the fine sand fraction (Appendix 9). At the channel margin this unit grades up to a slightly more silty sand that may have been deposited as the upper part of a channel bar or the initial stage of floodplain sediment.

Overlying the channel deposit and underlying the floodplain surface is a vertically-accreted proximal overbank deposit (Profile 2). This sediment is also unimodal with a fine sand mode, but is a sandy loam rather than sand as in the underlying channel deposit (Appendix 9). Silt and clay fractions of the overbank sediment gradually decrease toward the upper portion of the deposit. The near absence of pedogenic features and the upward decrease of silt and clay within a thickness of 1.8 m indicates that this is a depositional feature caused by a channel migrating northwest, toward this site.

The distal overbank sediment underlying the floodplain surface (Profile 1) also has a unimodal coarsening upward texture, but the loam is more poorly sorted and is finer grained than that at the more proximal site (Profile 2) (Appendix 9). Though this grain size increases upward to a silt loam and a sandy loam, it does so more erratically than at the proximal site (Profile 2). In some samples the mode is in the coarse silt fraction in other samples it is in the fine sand fraction. This irregularity in texture, its presence in a slight swale on the floodplain, a thicker sequence of overbank sediment, and its position near a terrace scarp suggests that these more distal sediments are filling an old channel. Profile 1 is at the same location as the estimated channel position for the overbank sediment underlying t-1 (see discussion in section on channel location).

Historic Sediment

On December 3, 1982 the largest recorded flood of the Buffalo River occurred. The stream gage at Rush was not operational at that time, but historic reports and preserved sediment record that flood water covered t-1. This is at least 9.2 meters above the water level of September 9, 1989. A stream gage on the Buffalo River at St. Joe, Arkansas, 36 km (22.4 miles) up valley from Rush, recorded a maximum discharge of 4,474 m /sec (158,000 ft /sec) (Lamb and others 1986). The average discharge for 47 years of record is 29 m /sec (1,037 ft /sec), two orders of magnitude less than the 1982 flood.

This flood deposited overbank sediment on the modern floodplain. Approximately 0.76 m (2.5 feet) of sand was deposited on the Rush campground (Spears 1986). At Profile 2, 0.45 m (1.48 feet), sand loam from the 1982 flood or a combination of several recent flood deposits is preserved.

Spears (1986 control column 1) and Dixon, (1986) also report an older historic flood sand deposit on the Buffalo River floodplain at Rush. The older unit is separated from the 1982 deposit by a humic layer. This older sand may be the result of the 1915 flood, the second highest flood of historic record. (Lamb and others 1986).

At all sites examined in this study the historic flood sediment was appreciably coarser than the underlying prehistoric overbank deposit with an increase in the absolute percent of sand of 9 to 36 (Appendix 9). Although the modal fraction of the 1982 deposit at all sites is fine sand, similar to older overbank deposits, the percentage of fine sand is slightly less and the percentage of very fine sand is slightly greater in the 1982 deposit than in the underlying overbank sediment. This contrast occurs both with the overbank sediment that underlies the modern floodplain and with overbank sediment 2 beneath Terrace 1.

Terrace 1

Sediment underlying the lower terrace is also overbank sediment and can be divided into three depositional units. Overbank 1 is the oldest unit and occurs along the inner edge of the terrace (Figure 5-4). It is overlain by Overbank 2. The latter unit is the most extensive unit present and it underlies most of the terrace. The youngest unit is the thin 1982 flood deposit.

Overbank 1

The oldest unit, is exposed at the base of Trench 1 at 11 m and in Trench 2. It is easily distinguishable from the overlying overbank 2 because a buried soil is developed in the older unit. Overbank 1 is comprised of channel gravel overlain by overbank sediment (Strata 1a and 1b, Figures 5-5, 5-6, and 5-7). Grain-size of the overbank sediment gradually and consistently becomes finer grained toward the top of the unit (Appendix 9). It changes from a sandy clay, to a sandy clay loam, to a loam. In the bottom 1.13 m the deposit is unimodal

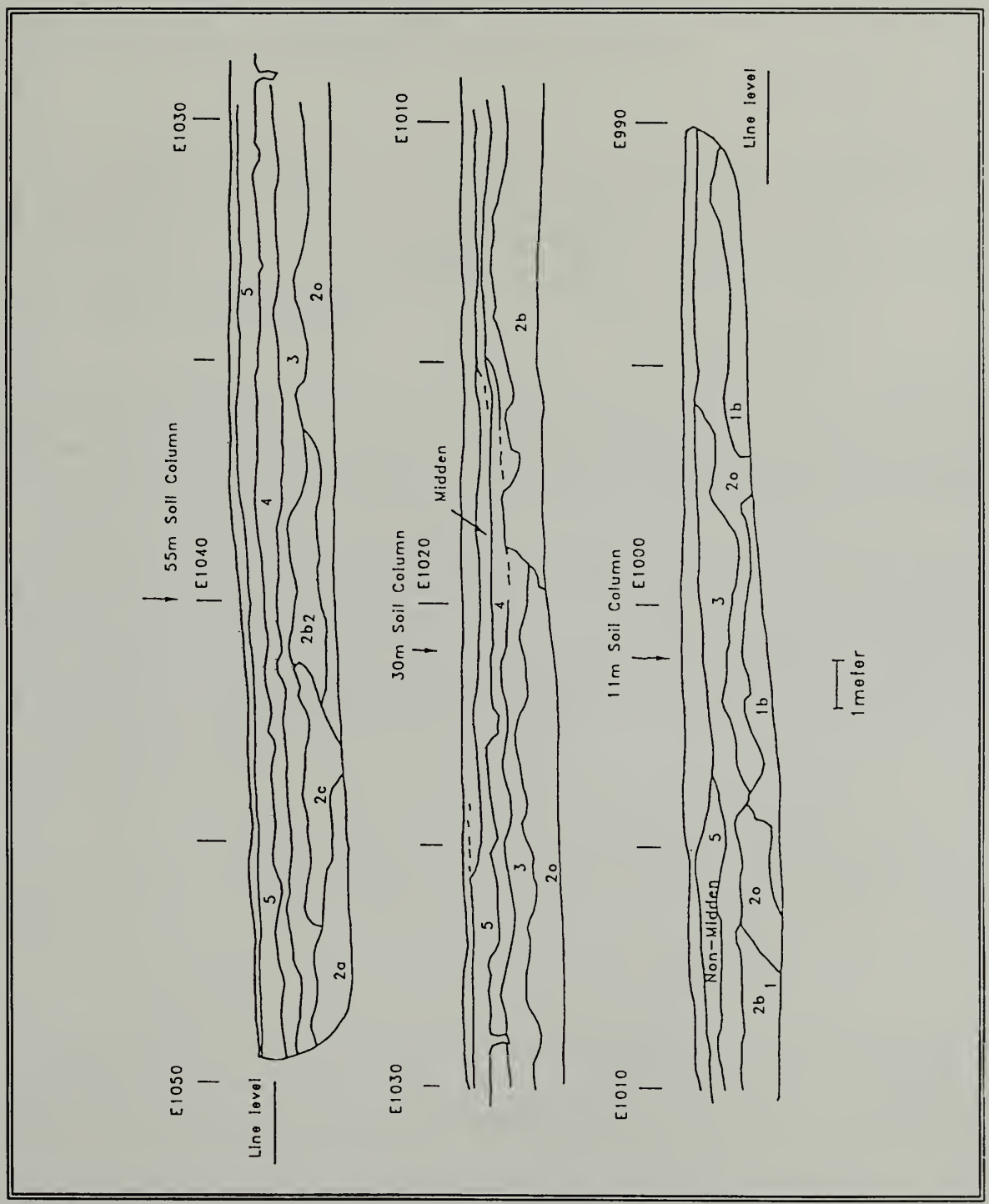


Figure 5-5. South wall profile map, Backhoe Trench 1. Soil columns denoted at 55 m, 30 m, and 11 m are the sampling points for sediment analysis.

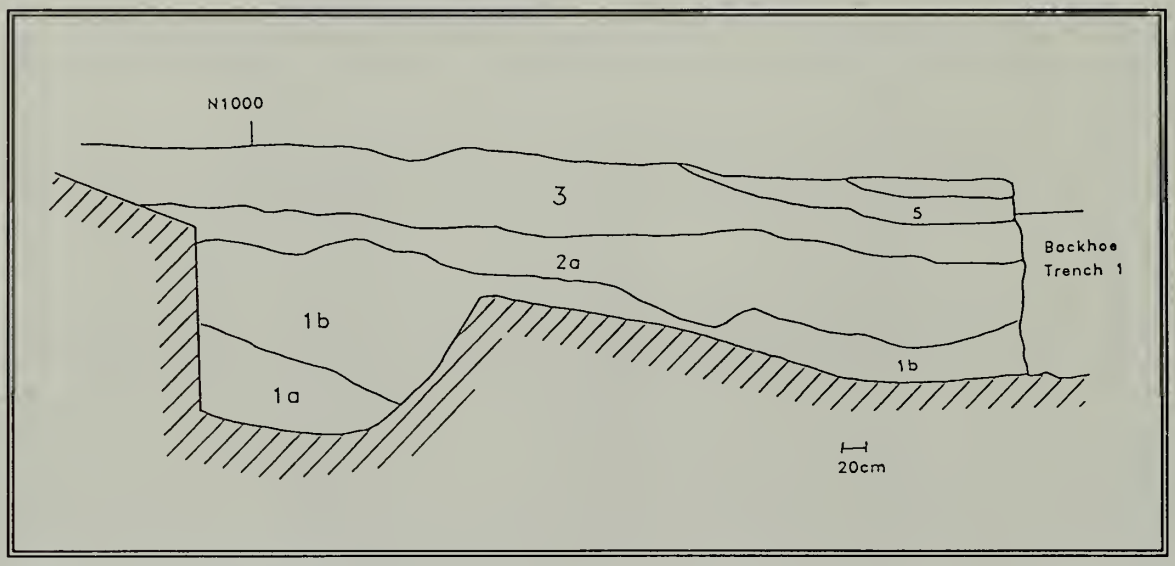


Figure 5-6. East wall profile, Backhoe Trench 2.

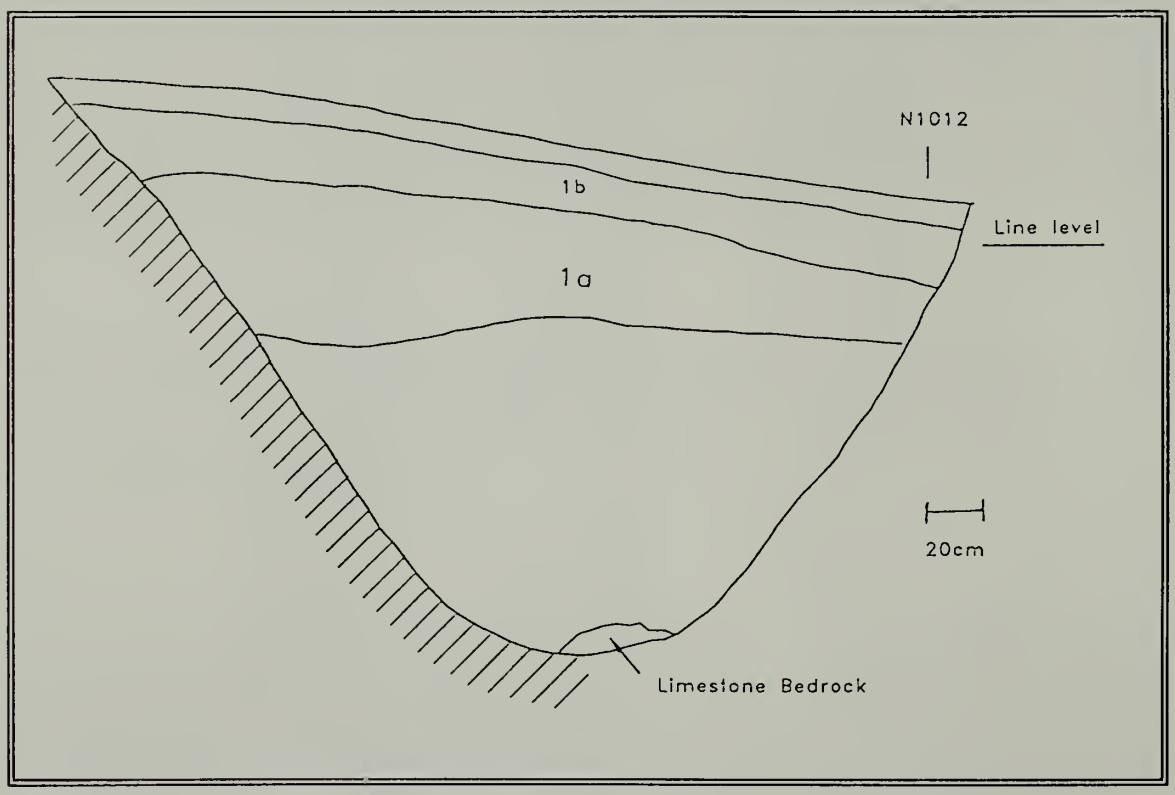


Figure 5-7. East wall profile, Backhoe Trench 3.

with a mode in the fine sand fraction or bimodal with modes in the fine sand and coarse silt fractions. The upper 0.51 m of the deposit is a bimodal loam with modes in the fine sand and coarse silt fractions. This distribution of grain size indicates that the channel was migrating away (southeast) from the site. Sedimentation temporarily ceased or slowed appreciably and a soil developed in the deposit.

Overbank 2

The intermediate unit is exposed in Trenches 1 and 2 and underlies nearly all of t-1 (Figure 5-4). It is similar to the overbank sediment that underlies the modern floodplain. Proximal sediment of unit 2 near the terrace scarp is unimodal sandy loam with a fine sand mode (Trench 1 at 11, 30, and 55 meters) (Appendix 9). The more distal overbank sediment is loam that may be unimodal with a fine sand mode or bimodal with fine sand and coarse silt modes (Trench 2).

In contrast to Overbank 1, the grain size of Overbank 2 is nearly uniform with depth. Lithologic subunits described in the field (Strata 2-5 in Appendix 9 and illustrated in Figures 5-5 and 5-6) are subtle and do not have substantial or consistent variations in texture. Vertical trends in grain size are slight and are not consistent between the closely spaced sites and therefore are interpreted as small local variations in a uniform deposit. This sediment was derived from a nearly stable channel position adjacent to the terrace scarp.

Overbank 2 underlying t-1 is older than the overbank sediment associated with the modern floodplain. Two lines of evidence support this conclusion. First, the sediment occurs at a higher elevation than the modern floodplain surface and second the sediment is coarser grained near the terrace scarp than that of the adjacent floodplain sediment interpreted as distal overbank sediment. Therefore both deposits can not be derived from the same channel at the same time.

Historic Overbank

Seven to eight cm (0.26 feet) of sandy loam overbank sediment has been deposited on this low terrace during the 1982 flood. It is exposed in Trench 1 at 30 and 55 m of this study and is described in a previous section.

Terrace 2

Sediment underlying the upper terrace is also overbank sediment, but it is considerably different from the younger overbank sediment associated with the lower terrace and the modern floodplain. Unlike the proximal overbank sediment beneath t-1 and the modern floodplain, sediment associated with t-2 in Trenches 4 and 6 is a more distal overbank sediment. Nearly all of the deposit is comprised of bimodal sandy loam with modes in the medium sand and coarse silt fractions (Appendix 9). The coarser sand mode in this sediment compared to younger overbank deposits may be due to two possibilities. First, the sediment source for t-2 was coarser than

the source for t-1 and the floodplain. Second, the competence of the stream which deposited the overbank underlying t-2 was greater than that of the stream which deposited sediment associated with t-1 and the present stream. Floods of the magnitude that occurred in 1982 would suggest that waning competence is not the cause for decreasing sand size in modern overbank sediment compared with that in t-2.

Grain size of the t-2 overbank deposit fines upward. This is similar to the older t-1 overbank deposit and dissimilar to the younger t-1 deposit and the modern overbank. Gradually changing grain size suggests that the channel position migrated away from both Trenches 4 and 6.

Channel deposits associated with t-2 are also unlike those associated with the modern channel because they are thinner and coarser grained. Those associated with the upper terrace are a maximum of 1.1 m thick and are comprised of more poorly sorted medium to coarse-grained sand and gravel (Trenches 3, 5, and 6). In contrast, channel deposits beneath the modern floodplain are 1.9+ m thick and are comprised of better-sorted, finer grained sand. No gravel is exposed below this surface.

Total thickness of both overbank and channel deposits below the upper terrace is also less than that below the modern floodplain and probably the lower terrace. Sediment below t-1 varies from 1.6 m (Trench 3) to more than 2.4 m (Trench 4) thick, in contrast to sediment below the floodplain which is a minimum of 6.15 m thick.

Source

The sediment in the study area could have been derived from the Buffalo River or its tributary, Rush Creek. To determine which stream was the source, the distribution of the grain size for each deposit was examined (Guccione 1988 and 1989).

Floodplain

The source of sediment underlying the modern floodplain was determined using Profiles 1 and 2. These sites are located in a transect approximately perpendicular to the Buffalo River and parallel to Rush Creek (Figure 5-3). The mean sand/(sand + silt) percent becomes finer grained with increasing distance from the Buffalo River, indicating that this stream is the sediment source. In Profile 2 the percent is 75 and in Profile 1 it is 52. Using the grain size-log distance plot (Figure 5-8), the respective channel positions should be 24 m and 53 m distant from the sites. The actual distance from the present channel is 20 m and 45 m. Conversely, if Rush Creek was the sediment source, the grain size at these two sites and the calculated distances to the channel from these two sites should be approximately the same because the transect is oriented parallel to the creek. The grain size at these sites is not similar and therefore Rush Creek is not the source of the floodplain sediment.

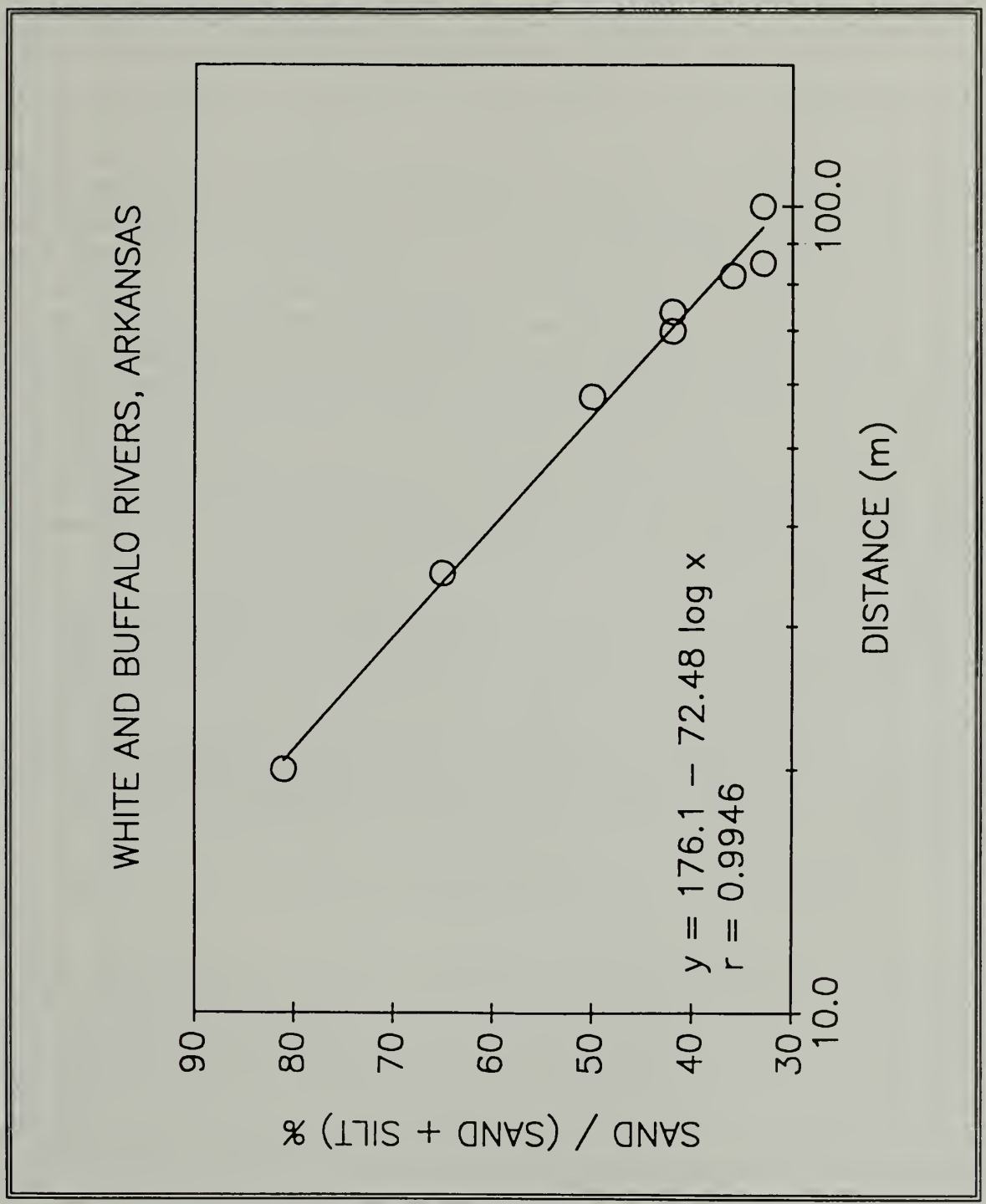


Figure 5-8. Grain size-log distance plot of the clay-free overbank sediment using the total sand fraction. Locations are from the White River near Fayetteville, Arkansas, and the Buffalo River near Erbie, Arkansas.

Terrace 1

The source of Overbank 2 underlying the low terrace was determined using Trenches 1 and 2. Trench 1 and the three sample sites in it were oriented approximately parallel to the present channel of the Buffalo River and perpendicular to the present channel of Rush Creek (Figure 5-3). Using samples sites in both Trenches 1 and 2, this transect is approximately perpendicular to the Buffalo River and parallel to Rush Creek. Assuming that the paleochannels of the two streams were approximately parallel to their present courses, the grain size of overbank sediment from each site in Trench 1 should be similar if the source of the sediment is the Buffalo River. The mean sand/(sand + silt) percent is 67 at 55 m, 63 at 30 m, and 60 at 11 m. Using the grain size-log distance plot (Figure 5-8), the respective channel positions should be 32, 36, and 40 m distant from the sites. These are similar distances and are reasonable if the Buffalo River was the source of the sediments. Conversely, if Rush Creek was the source of the sediment, the grain size should fine with increasing distance from the creek. The difference in the distance from the sites to the channel should approximately be the same as the difference in the distance between the sites. The actual distance between the first and second sites is 25 m, but the calculated distance between these sites and the channel is only 4 m (36 m - 32 m = 4m). The actual distance between the second and third sites is 19 m, but the calculated distance between these sites and the channel is only 4 m (40 m -36 m = 4 m). Therefore, the conclusion is that Rush Creek was not the source of the Overbank 2. The transect perpendicular to the Buffalo River using Trenches 1 and 2 confirms this conclusion.

The source of Overbank 1 was also determined using Trenches 1 and 2. This transect is approximately perpendicular to the Buffalo River and parallel to Rush Creek. The grain size fines with increasing distance from the Buffalo River indicating that this river is the sediment source. Sand/(sand + silt) percent of the upper Overbank 1 deposit in Trench 1 is 60 and in Trench 2 is 54. Using the grain size-log distance plot (Figure 5-8) the respective distances to the channel should be 38 m and 48 m, a difference of 10 m. The actual distance between the sites is 6 m. Therefore, the conclusion is that the Buffalo River was also the source of the Overbank 2.

Terrace 2

The source of the sediment underlying the high terrace is more difficult to determine than that of t-1 and the floodplain because the orientation of Trenches 4 and 6 is at a diagonal between the Buffalo River and Rush Creek. In Trench 4 the mean sand/(sand + silt) percent of the uppermost overbank sediment is 73 and in Trench 6 it is 60. Using the grain size-log distance plot (Figure 5-8), the respective channel positions should be 26 and 40 m distant from the sites. A tangent drawn along the south side of two circles around the sites is approximately parallel to the Buffalo River and a tangent drawn along the northwest side of the circles is approximately parallel to Rush Creek. This evidence does not provide any conclusion.

Other evidence can be used to speculate about the source for the t-2 overbank sediment. Grain size of this deposit is coarser than that of any other younger overbank deposits definitely derived from the Buffalo River. This suggests that Rush Creek is more likely to be the sediment source. It is a small tributary and today is transporting coarser sediment than the Buffalo River.

Soils

Soil pedons developed on both the floodplain and the lower terrace are quite similar and are classed as the Wideman series (Ward and McCright 1983). The series is an entisol (typic udifluvent) with a thin (15 cm) A horizon over a C horizon. Locally the A horizon is overthickened where anthropomorphic activity has been concentrated and middens have formed. It is a young soil and indicates that the overbank sediment that underlies t-1 and the floodplain is relatively recent. Both these deposits have accumulated rapidly enough and are recent enough to prevent substantial pedogenesis. This is not surprising for the overbank sediment associated with the modern floodplain, but it is surprising for the sediment associated with a low terrace. Similar sedimentation rates and soils do not occur on the low terrace of the Buffalo River at Erbie, Arkansas (Guccione 1988).

Also unusual for terrace sediments in the Ozarks is the presence of a buried soil. The pedon that separates overbank deposits 1 and 2 below t-1 is a more strongly developed soil than that which occurs at the surface of the terrace. This soil has a dark yellowish brown A horizon and a mottled reddish brown, brown, and yellowish brown argillic B horizon in excess of 164 cm thick. These horizons are similar to those of the Healing series (typic argiudoll) (Ward and McCright 1983) but they have a loam texture rather than a silt loam or a silty clay loam texture.

The soil developed in the overbank sediment that underlies the upper terrace is the Britwater series (Ward and McCright 1983). This series is a typic paleudult with a dark yellowish brown A horizon over a thick, red and brown mottled argillic B horizon. Similar to the buried soil beneath t-1, this pedon is more sandy (sandy loam) than the series (silt loam, clay loam, or silty clay loam). This is the most strongly developed soil in the study area and has formed on a landscape that has been stable for a long time.

Chronology

Sediment

Floodplain

Only the historic overbank alluvium that has accumulated on the present floodplain has been dated directly. Historic artifacts incorporated within the deposit and historic accounts (Spears 1986 and this report) have dated the uppermost sand above a humus as the result of the 1982 flood. A similar sand unit below the

1982 deposit also includes historic materials. These are not diagnostic, but are consistent with a date of 1915, the second highest historical flood on record (Spears, personal communication 1989).

Prehistoric overbank alluvium that has accumulated on the present floodplain has only been dated indirectly. This sediment must have accumulated since the deposition of overbank sediment underlying the low terrace. These t-1 sediments have been dated by radiocarbon dates and stratified diagnostic cultural artifacts. The youngest clearly stratified archeological materials in overbank deposits associated with t-1 are from the Late Archaic to Early Woodland periods and the later is the preferred interpretation (Sabo this report). These periods date 5,000 to 2,500 years B.P. (Late Archaic) and 2,500 to 1,800 years B.P. (Early Woodland) (Table 5-1). Therefore modern floodplain sedimentation began no more than 5,000 years ago and probably began less than 2,500 years ago.

Human occupation of the t-1 surface continued during the Middle Woodland to Early Mississippian (Sabo this report). However, little if any sediment accumulated during that time and the midden that developed has been dated between 1,670 and 840 years B.P. This strongly suggests that incision and/or channel avulsion had occurred and a new channel had formed by 1,670 years B.P. Therefore, modern overbank deposition probably began less than 2,500 year ago and was in the process of forming by at least 1,650 years B.P., making it late Holocene. An alternate but less likely hypothesis, is that the t-1 surface continued to slowly aggrade during the Middle Woodland to Early Mississippian periods. This aggradation was slow enough that cultural components of 830 years duration are not stratified. If this is the case, the modern floodplain did not begin to form until less than 840 years ago.

Since incision and/or avulsion of the present channel between 5,000 and 840 years ago, at least 2.1 m of overbank sediment have accumulated on the floodplain and 3.8 m of sediment have filled the abandoned channel. If accumulation began 5,000 years ago, the minimum possible accumulation rates would be 0.042 to 0.076 cm/year. If accumulation only began 840 years ago, the maximum possible accumulation rates would be 0.263 to 0.452 cm/year. Using the preferred dates of initiation for the floodplain between 2,500 and 1,670 years B. P., the accumulation rates would range between 0.084 and 0.152 cm/year to 0.126 and 0.228 cm/year. These rates are considered the most likely.

Terrace 1

Overbank alluvium 1 associated with the low terrace has not been directly dated. It can be relatively dated using diagnostic cultural artifacts stratified within the Overbank 2 alluvium above it. The oldest cultural material at the base of this deposit is from the Dalton period, dated between 9,000 and 10,000 years B.P. (Table 5-1). Therefore Overbank 1 must be older than 9,000 years.

A buried soil developed in the Overbank 1 indicates that deposit formed a stable surface and weathered subsequent to its deposition. This soil has a solum 176+ cm thick, an argillic horizon, and 7.5YR and 5YR

mottles (Appendix 9). It is much more strongly weathered than the Wideman soil developed on the t-1 surface, which probably formed in less than 2,500 years and more than 1,670 years. It is more strongly developed than the Leadvale soil formed on the low terrace at Erbie, Arkansas (Guccione 1988). The Leadvale soil also has an argillic horizon, but the solum is only 81 cm thick and the most oxidized color is 7.5YR. It is developed in sediments that are 6,000 to 7,000 years old. It is also more strongly developed than the Spadra Soil on a low terrace of Moore Creek, a tributary to the Buffalo River at Boxley (Guccione 1989). The Spadra Soil has an argillic horizon, a solum more than 100 cm thick, and a hue of 7.5YR. This soil is developed in sediments that ceased accumulating less than 5,750 years ago. Comparison of the buried soil with these three surface soils suggests that Overbank 2 weathered for at least 6,000 years and therefore the deposit is probably in excess of 15,000 (9,000 + 6,000) years old or late Pleistocene.

No accumulation rate can be calculated because the sediments have not been adequately dated.

Overbank alluvium 2 that underlies most of the low terrace contains stratified archeological materials that date from the Dalton period (10,500 to 9,000 years B.P.) at the base to the Late Archaic (5,000 to 2,500 years B.P.) or Early Woodland (2,500 to 1,800 years B.P.) periods near the top of the unit. The beginning of midden formation is dated at 1,670 years B.P. and is the youngest probable age of the deposit. This is a maximum span of 8,830 years and a minimum span of 4,000 years. The maximum is considered more likely.

During this time interval, estimated to be no more than 8,830 years long, 1.07 to 1.80+ m of overbank sediment accumulated above the paleosol developed in the Overbank 1 deposit. The maximum mean accumulation rate is 0.027 to 0.045+ cm/year. The minimum mean accumulation rate is 0.012 to 0.020+ cm/year and these values are considered to be more likely. These rates are an order of magnitude less than the most likely mean accumulation rate of the modern floodplain.

Terrace 2

Overbank alluvium associated with terrace 2 has not been directly dated, but it can be relatively dated. It is older than the sediment that underlies t-1 and thus is estimated to be older than 15,000 years. The Britwater soil formed in this deposit is strongly developed and supports a late Pleistocene age.

Soils

Wideman Soil

The Wideman soil on the lower terrace has had a maximum of 5,000 years and a minimum of 1,650 years to develop. The minimum period of time is more likely on the basis of the archeological information (Sabo this report) and the degree of soil development. A terrace soil that has developed in 6,000 to 7,000 years at Erbie, Arkansas is at least 0.8 m thick with A, E, and argillic B horizons (Guccione 1988). A terrace soil that

has developed in more than 5,000 years at Boxley, Arkansas is 1.1 m thick with A and argillic B horizons (Guccione, 1989). Both of these soils have developed in approximately the same length of time as the maximum possible age of the lower terrace, but the soils are much more strongly developed than the soil that occurs on t-1. Therefore it is unlikely that the Wideman soil has been forming for 5,000.

The Wideman soil is more similar to Ceda soil developed in the younger sediment underlying the Buffalo River floodplain at Boxley, Arkansas. Both the Ceda and Wideman soils have an A horizon but do not have a B horizon (Guccione, 1989). The parent material of the Ceda soil was deposited between 1,800 and 1,100 to 500 years B.P. and thus the Ceda soil must be younger than 1,800 years old. This is equivalent to the estimated age of the Wideman soil on t-1.

Britwater Soil

The Britwater soil that is present on the upper terrace has developed in more than 10,000 years and probably more than 15,000 years. The thick solum (1.2-2.5 m), the presence of A and argillic B horizons, and the red (5YR to 2.5YR colors) support the observation that this is a strongly developed soil that has weathered for a relatively long period of time. The soil is more strongly developed than any Holocene soils previously examined on the terraces of the Buffalo River at Boxley, Erbie, or Rush (Guccione 1988 and 1989).

Channels

The age of the paleochannels can be determined utilizing the age of the sediments derived from them. The modern channel and three paleochannels have existed during the development of the preserved terraces and floodplain along the Buffalo River near Rush. Two of these channels are Holocene and the other two channels are Pleistocene. Holocene channels are associated with the modern floodplain and the outer portion of the lower terrace. Late Pleistocene channels in the study area are associated with the inner portion of the lower terrace and the upper terrace.

The present channel of the Buffalo River downcut to its present level and/or avulsed toward the southeast during the late Holocene. Establishment of the present floodplain could not of begun more than 5,000 years ago and probably occurred between 2,500 and 1,650 years ago. Since that time it has aggraded rapidly.

Two channels were active during the development of the lower terrace. The youngest channel, paleochannel 1, was active during the latest Pleistocene and the major portion of the Holocene. Beginning approximately 15,000 years ago the channel that had been the source of the older overbank sediment ceased to supply sediment to its floodplain because the channel had incised or floods and sediment supplies were inadequate. During this period, which lasted approximately 5,000 or 6,000 years, no sediment was accumulated at the site of Trench 1 and 2. Aggradation later became the dominant process and sediment derived from this channel

began to accumulate at this site between 10,500 and 9,000 years B.P. It continued until approximately 2,000 years B.P. and partially buried a late Pleistocene floodplain.

The older channel associated with t-1 (paleochannel 2) was active during the late Pleistocene. It was abandoned no later than 9,000 years ago and was probably abandoned about 15,000 years B.P. The age of its original formation is unknown. This channel was the source of the Overbank 1 deposit.

The oldest known channel, (paleochannel 3) is associated with t-2. It must have been active more than 10,000 years ago and probably considerably more than 15,000 years old.

Location of Paleochannels

The modern channel and three paleochannels have existed during the development of the floodplain and present terraces of the Buffalo River near Rush (Figure 5-9). Channel positions were reconstructed using three possible lines of evidence. Geomorphic evidence and the presence of channel fill were used to locate one paleochannel (paleochannel 1). Sediment grain size and the grain size-log distance plot of overbank deposits along Ozark streams (Figure 5-8) were used to help locate former positions of the modern channel and all the paleochannels. The modern channel and paleochannels 2 and 3 migrated during their existence. Only their final position is shown on Figure 5-9.

During the late Holocene the channel of the Buffalo River has only migrated a short distance. By at least by 1,650 years B.P., the Buffalo River channel position was the farthest southeast that it has been since the late Pleistocene and was cutting into its southeastern valley wall. It has episodically migrated approximately 10 m back toward the northwest to its present position. Using the grain size-log distance plot, the most distant position of the channel was 30 m to the southeast of Profile 2. Its present position is 20 meters from Profile 2. Overbank sediment that underlies the modern floodplain and infills paleochannel 1 was derived from this channel. Accumulation of cultural material in the overbank sediment that underlies the floodplain is minimal except in the channel fill of paleochannel 1 (Spears 1986). This suggests that the floodplain was not extensively utilized during the last 1,650 years or that the accumulation rate has been rapid enough to bury many of the cultural materials that are present.

The channel position during early, middle, and part of the late Holocene (paleochannel 1) was 45 m northwest of the present channel and 12 m southeast of the terrace scarp. This position was estimated using the sediment grain size at three sites in Trench 1 and the grain size-log distance plot (Figure 5-8). The estimated distance to the channel is determined from the grain size-log distance plot. A circle with the radius equal to this estimated distance is drawn around each sample site (Figure 5-9). The tangent along these circles is the approximate position of the paleochannel. It corresponds to the presence of dark-colored and erratic-textured sediment (Profile 1, Appendix 9) beneath a small swale in the floodplain, now exposed in a cut made

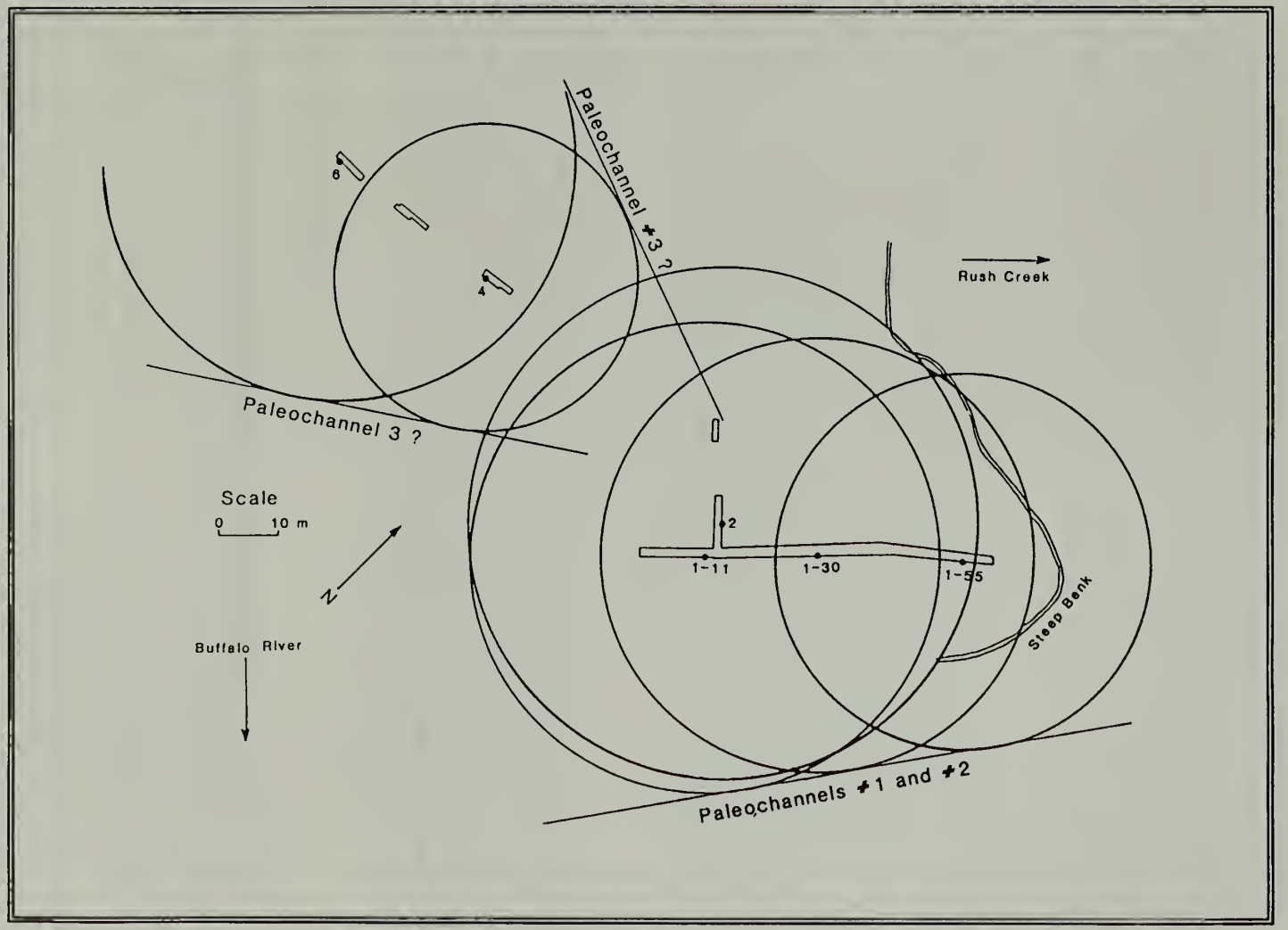


Figure 5-9. Graphical determination of paleochannel locations near Rush using grain size and the grain size-log distance plot (Figure 5-5). Paleochannel 1 is calculated to be 32 m from T-1 (55 m sample site), 36 m from T-1 (30 m sample site), and 40 m from %-1, (11 m sample site). A circle with the radius equal to the distance of the channel from the sample site is drawn around each site. A tangent connecting the circles locates the paleochannel position. The terminal position of paleo-channel 2 is 43 m from T-2. This is approximately the same as paleochannel 1. The terminal position of paleo channel 3 is 26 m from T-4 and 40 m from T-6. Tangents connecting these circles illustrates two possible channel position.

for a railroad grade (Spears 1986). The lowest elevation of this overbank sediment interpreted as channel-fill occurs below that of the channel sand exposed in Profiles 3 and 4. These multiple lines of evidence confirm the location of the channel as that estimated using grain size. This channel position remained stable throughout most of the Holocene and was the source of the overbank sediment that underlies most of the low terrace.

During the late Pleistocene the Buffalo River channel (paleochannel 2) was not stable. It was initiated near Trench 2 and migrated southeast to a position where it stabilized for most of the Holocene (paleochannel 1) (Figure 5-9). No independent evidence is available to substantiate these successive channel positions. They have been estimated using the sediment grain size of Trench 2 and the grain size-log distance plot (Figure 5-8). This migrating late Pleistocene channel deposited a fining upward sequence of overbank sediment that formed the initial floodplain underlying t-1. When the channel reached the position of paleochannel 1, accumulation ceased or slowed down sufficiently so that a soil formed. The lack of sedimentation may have been due to renewed downcutting or a reduction of flood events and/or sediment load at this time. Ultimately this floodplain was buried by overbank sediment associated with paleochannel 1.

The oldest known channel (paleochannel 3) in this section of the Buffalo River, was also unstable. It migrated toward the northeast if it was Rush Creek or toward the southeast if it was the Buffalo River. Two terminal channel positions were estimated using the grain size of the youngest overbank sediment in Trenches 4 and 6 and the grain size-log distance plot (Figure 5-8). If the channel was Rush Creek, its last position was along the terrace scarp, located approximately at Trench 3 (Figure 5-9). This is considered to be the more likely possibility (see discussion in previous section). In contrast if the channel was that of the Buffalo River, its last position appears to intersect the terrace margin at an oblique angle. This is an unlikely geomorphic relationship.

Evolution of the Buffalo River

The study of three sites along the Buffalo River can provide some idea about the late Pleistocene and Holocene evolution of the river.

The river valley and channel of the Buffalo River is straight in the headwaters and becomes more sinuous downstream. The headwaters have incised up to 400 m into the Boston Mountain Plateau. The straight channel and valley pattern may be the result of headward erosion. Downstream the channel has incised approximately 200 meters into the Springfield and Salem Plateaus. Here the channel and the valley walls are more sinuous. These meanders appear to have been inherited from a much earlier stage of river development, prior to the deep incision of the valley.

Most of the incision of the Buffalo River is not recorded by any sedimentary deposits. The valley walls have retreated as downcutting proceeded and most alluvial deposits adjacent to the valley walls have also been eroded. A possible exception may be at Dry Ford near Erbie. Detailed study of this site has not been con-

ducted yet but a brief field inspection of the site suggests that some older deposits are preserved approximately 25 m above the present floodplain.

In the valley bottoms the oldest sediments are estimated to be late Pleistocene, considerably in excess of 15,000 years old. These sediments are preserved beneath the 8 m high terrace at Rush and may be derived from Rush Creek, a tributary of the Buffalo River. If these are Rush Creek sediments, the Buffalo River has moved across the entire width of it valley bottom in approximately 15,000 years (Table 5-2).

Table 5-2. Estimates of floodplain and terrace ages and lateral migration rates of the Buffalo River using radiometric dates, diagnostic cultural material, sedimentation rates, and soil development.

Floodplain Age	Boxley 0-4,000 years	Erbie 0-4,000 years	Rush 0-4,000 years
Terrace 1			
Height above floodplain	3 m	4 m	4 m
Age #2	?-5,000 years	?-4,000 years	2,000-10,500 years
Age #1	--	>6,000 years	>15,000 years
Terrace 2			
Height above floodplain	--	--	8 m
Age	--	--	>15,000 years
Lateral migration	0.14 m/years	0.05 m/year	0.05 m/years
Floodplain	(700 m/5,000 years)	(180 m/4,000 years)	(95 m/2,000 years)
Terrace 2	--	--	0.02 m/years (300 m/15,000 years

A low terrace, approximately 4 m above the floodplain, is present at Rush, Erbie, and along a tributary at Boxley (Table 5-2). At each of these sites the floodplain sediment was accumulating during the middle Holocene. At Boxley this active floodplain (later Terrace 1) had already accumulated 0.6 m of sediment prior to 6,010 years B.P. Only 35 cm of sediment have accumulated since that time and soil development on this landform suggests that accretion slowed down or ceased shortly after 5,750 years B.P. (Guccione 1989). At Erbie 0.96 m of sediment had accumulated prior to 6,000 or 7,000 years ago. Only 45 cm have accumulated since that time and a cultural feature associated with the plow zone is 3,040 years old. This feature near the land surface and soil development on the landform suggests that accretion slowed down or ceased prior to 3,040 years B.P. (Guccione 1988). At Rush the t-1 floodplain was accreting between 10,500 and 2,500 to 1,650 years B.P. During this time more than 1.9 m of sediment accumulated. Soil development on this landform confirms that the accretion slowed down or ceased more recently than at Erbie or Boxley. In summary, overbank sedimentation during the early and middle Holocene was relatively thin upstream and it becomes thicker and sedimentation continued more recently downstream.

The modern floodplain of the Buffalo River has formed during the late Holocene throughout its valley and probably began to form during the middle Holocene in the upstream portion of the valley. At Boxley the floodplain is at least 1,800 years old and Spears (1989) estimates that it has been active for more than 4,000 years (Table 5-2). At Erbie the modern floodplain has been accreting at least 2,000 years and probably for more than 3,040 years (Guccione 1988). At Rush the floodplain began to form between 1,650 and 2,500 years B.P.

The width of the floodplain seems to correspond to its length of development. The valley bottom is widest at Boxley and the floodplain extends across the entire valley floor, approximately 700 m wide. In this segment of the river the channel moves across the entire width of its valley bottom in 4,000 to 5,750 years for a mean lateral accretion rate of 0.14 m/year (Table 5-2). At Erbie the valley bottom is narrower than at Boxley and the floodplain extends across nearly two thirds of the valley bottom, approximately 180 m. The channel has moved across this distance in 3,040 to 6,000 or 7,000 years (Guccione 1988) for an average lateral accretion rate of 0.045 m/year. At Rush the valley bottom is about the same width as at Erbie, but the floodplain is only about a third of valley bottom, or approximately 95 m wide. The channel has laterally migrated across this distance in approximately 2,000 years. The mean lateral accretion rate is 0.048 m/year, approximately the same as that at Erbie. This rate is higher than the estimated mean lateral accretion rate of 0.02 m/year for the previous channel migration across the valley at Rush.

Paleoenvironment During Human Habitation

This study allows a reconstruction of the physical environment at the time of human habitation. The channel was 25 m southeast of the occupation site on the floodplain of the Buffalo River throughout most of the Holocene. During the Dalton to Middle Woodland periods the channel periodically flooded and the occupation site accreted upward at a fairly continuous rate. A more intensely occupied Late Archaic site was present on a low terrace of Rush Creek. This site was about 88 m northwest of the Buffalo River channel and was not subjected to flooding.

Prior to the final, intense occupation of the site from Middle Woodland to early Mississippi periods, the Buffalo River channel had migrated and probably incised to approximately its present position. Flooding was not a substantial problem during this period of time. Only since historic time and clearing of vast tracts of land has flooding again become a problem at the site. Presumably the sediment concentration of the river is greater and flooding has resulted in thicker and coarser grained sedimentation than any time during the Holocene. This change in sedimentation pattern is observed both on the floodplain, which frequently floods (Spears, 1986), and on the low terrace.

Cultural Strata

The preceding analysis presents the depositional sequence and history of the naturally deposited strata upon which the prehistoric occupation of 3MR80 took place. Our focus in these excavations, though, is the

discrete cultural strata as identified by SPEARS and refined in the present work. Cultural strata, as defined in the next chapter, refers to sediments deposited by or substantially altered as a consequence of human activity. By definition we have therefore identified five cultural strata contained within the upper two meters of the terrace as exposed in Backhoe Trenches 1, 2 and 3 (Figure 5-10). These cultural strata correspond to those identified by Dixon (1986:117,118 and Figures 6-24 and 6-25). Our purpose in backhoe trenching was to expose the earlier defined strata to guide excavation and to define the relationships between the strata across Area D. This discussion applies only to the triangular portion of 3MR80-Area D east of the campground road; additional cultural strata were identified elsewhere on the site in Areas A, B and C (Spears et al. 1986) and in Trench 4 (Figure 5-10). The following strata descriptions are taken from our field notes and profile drawings of the three backhoe trenches referred to above and illustrated in Figures 5-5 through 5-7. Cardinal directions given in the report refer to the grid system, rather than a magnetic compass reading.

The backhoe trenches were initially excavated to a depth of two meters both because this was the depth of SPEARS trenches and in the interest of safety. This was also the most efficient depth for the operator to maintain straight walls. Trenches 2 and 3 were later extended to the maximum depth of the backhoe reach for the geomorphologists, but no additional cultural strata were discovered. Once the trenches were completed one wall was troweled clean from the surface to the floor (Figure 5-11). The cultural strata were then defined by the Project Director and Assistant Project Director (Sabo and Guendling). Cultural strata were defined primarily on the basis of macro-observation of textural changes in the sediments identified by picking the profile with the point of a trowel, color changes, and the distribution of artifacts. For example, the boundary between Stratum 5 (midden) and Stratum 4 (submidden) was a distinct color change, rather than a textural difference. The distribution of artifacts was the least important criteria in the differentiation of the various strata. It was gratifying, though, to recognize a layer of flat lying chert flakes at the upper boundary of Stratum 3, a boundary we had defined solely on the basis of texture. The artifacts thus were an independent means of confirming boundaries. Strata were defined from the top to the bottom of the trench in two meter sections, marked with tags (Figure 5-12) along the entire profile,and then mapped as soon as the trenches were completed. The trenches remained open for reference and interpretive purposes for most of the field session.

Backhoe Trench 1 (Figures 5-5 and 5-10) was placed on the south side of Area D oriented to the grid system. It attained a length of 60 m and an average depth of 2 m. The surface along this area gently slopes from west to east with a total difference of about 1 m drop in elevation. The floor was level most of the length, sloping up to the surface at the west end. Backhoe Trenches 2 and 3 were placed perpendicular to the first trench. Trench 2 intersected Trench 1, reached an effective length of 6 m and was deepened at the north end to expose the lower sediments (Figure 5-6). The sediments dipped south along the profile mirroring the surface topography. Trench 3 was placed at the highest point on Area D east of the campground road to cut through the "spine" of the landform. This trench attained a length of approximately 3 m (Figure 5-7) and reached bedrock at 1.75 m below the surface. The bedrock, in turn, was covered with extensive deposits of gravels arbitrarily assigned Stratum number 1a. These gravels were poorly sorted and embedded in a heavily weathered clay/sand matrix (7.5YR5/8 to 6/8). This deposit was interpreted as Pleistocene age lag gravels of the Buffalo River. No evidence of human occupation was noted in this stratum.

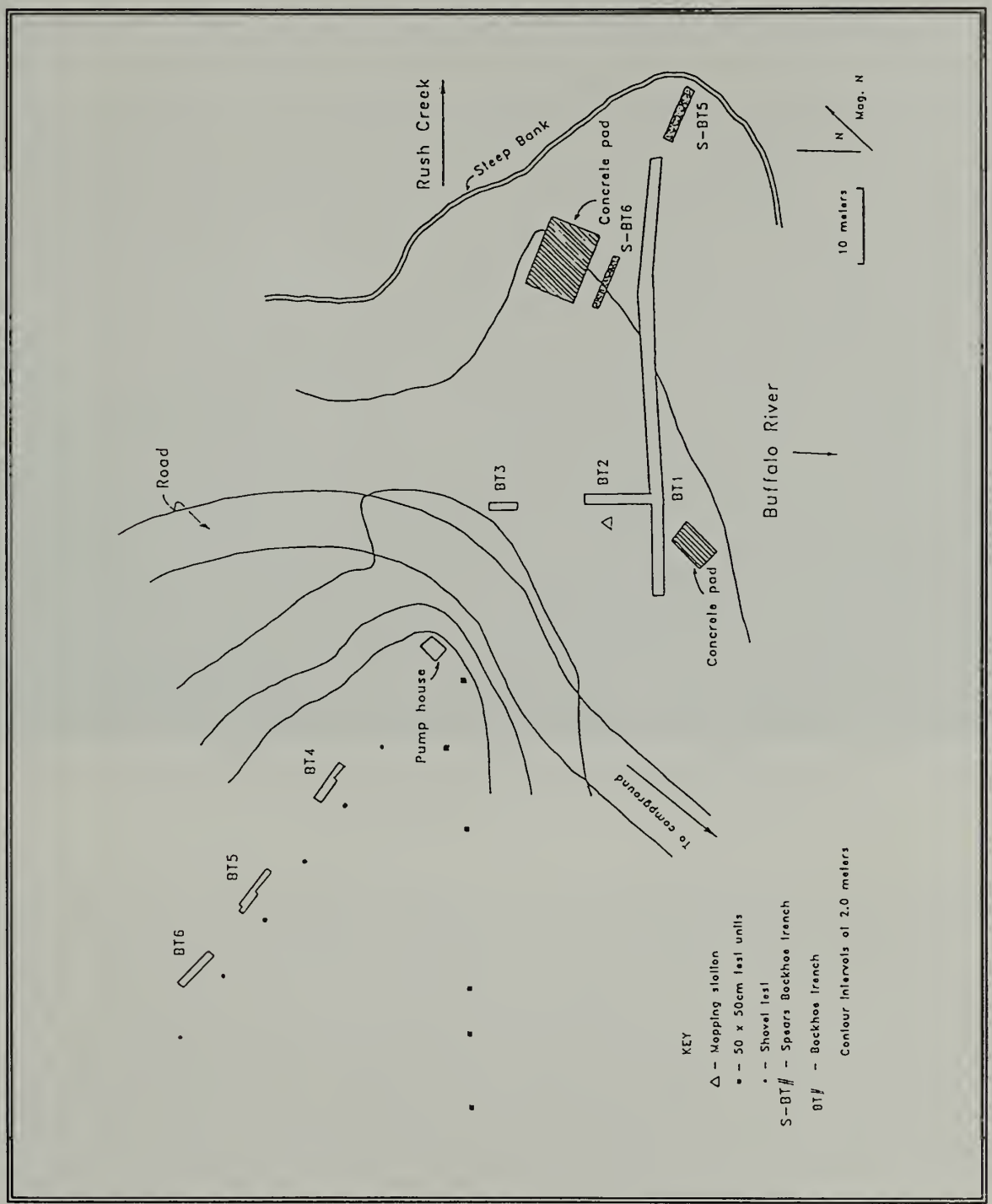


Figure 5-10. Backhoe trench placement, 3MR80-Area D.



Figure 5-11. Backhoe Trench 1 looking grid east. The south wall has been strung with lines for mapping guides (AAS Neg. #885902).

Stratum 1b was a hard consolidated clayey sediment overlying the 1a lag gravels. It had a high sand fraction, some grit and very small manganese nodules. The sediment was light colored (10YR5/4 to 6/4) and no large clasts were observed, but incipient clay skin development was noted. The sediment was heavily weathered. No organic material was noted and it was mapped in all three trenches. The upper contact of 1b was undulating as if eroded before being covered. Near the point at which 1b descends abruptly into the floor of Trench 1 (E1005, Figure 5-5), a dike of this sediment showed clearly in the profile with a large oxidized root cast oriented vertically. This clear structure indicated a tree stood at this spot when the overlying 2a sediments were deposited in flood episodes, and held the 1b material in place. Additional casts were observed in the strata. During the initial trenching a nearly whole Dalton point and an Early Archaic Rice Lobed point were discovered in this

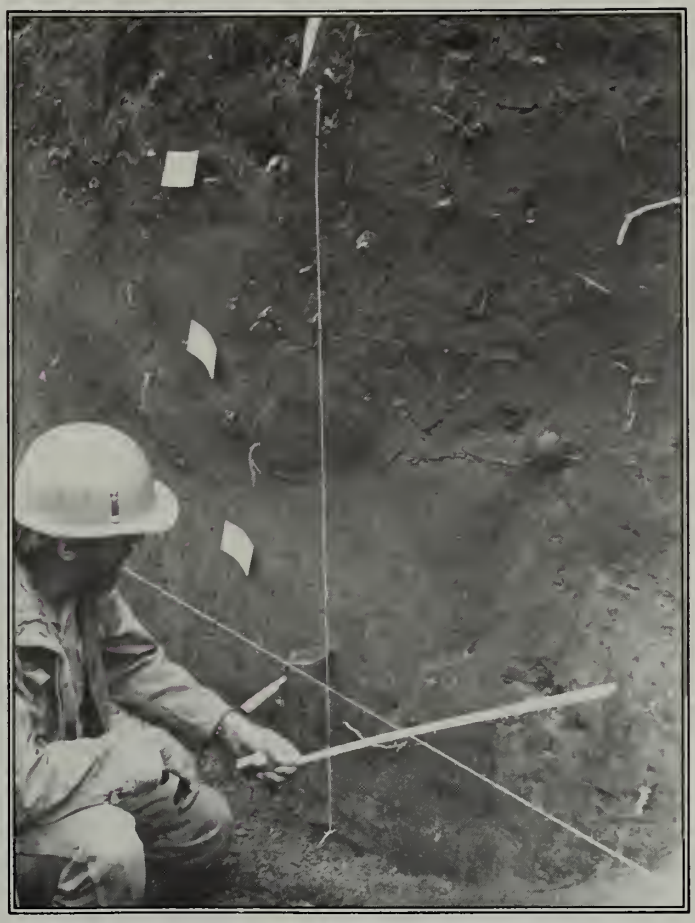


Figure 5-12. Profile mapping of section of Backhoe Trench 1. White tags mark numbered strata (AAS Neg. #885823).

sediment. The stratum was interpreted as a buried paleosol and was the earliest cultural stratum encountered on the site. These two strata, 1a and 1b, are the overbank 1 deposit as defined in the preceding section.

The overlying sediment, labeled 2a, appeared in Trench 2 and along the entire length of Trench 1. This is a massive overbank clay/silt/sand deposit (7.5YR4/6 with occasional lighter mottles) containing occasional large broken angular sandstone and smooth water-worn clasts and chert flakes. This stratum is thickest in the central portion of Trench 1, and has a higher organic content toward the western portion of the trench where it is closer to the surface. In this area the stratum contains part of an A Horizon development extending into it from above, and modern root systems have also penetrated it. Beginning in the central portion of Trench 1, a

series of cut and fill episodes were mapped as 2b (1 and 2) and 2c, and later identified as filled chute channels. John Dixon also mapped and identified a chute channel in the same stratum in SPEARS Trench 6 (1986, Figure 6-25). The chute channels are filled with a very hard, compact, very fine silt/sand sediment. The sediment contained very few inclusions, consisting of a chert flake or two, angular sandstone and water-worn clasts; the same types of inclusions as 2a. The difference between 2a and the other sub-strata lie in slight color differences (10YR5/8) and textural changes.

One noteworthy observation made during mapping of Stratum 2 was the presence of several large disturbances extending into the surface of 2a near E1005 in Trench 1. These appeared to be large cracks in the westward sloping edge of 2a, where it was overridden by 2b(1), that have been filled with a lighter colored sandy sediment. These cracks exhibit some oxidization along the margins and may indicate a mid-Holocene age for the stratum. Large dessication cracks such as these are sometimes found in sediments deposited during the Hypsithermal climatic event, when much drier and warmer weather conditions prevailed. Only three controlled excavation units reached Statum 2a and these produced a mixed assemblage of Archaic projectile points. However, the samples of items from the backhoe trenching included a majority of projectile points dating to the Early to Middle Archaic period which appeared to come from Stratum 2. The Hypsithermal climatic event spanned the Middle Archaic period.

Lying conformably above Stratum 2 along almost the entire length of Backhoe Trench 1 and in Backhoe Trench 2 was another overbank deposit. It was distinguishable from the underlying 2a deposit by its less consolidated structure and by a discernible lower clay fraction. Stratum 3 contained occasional angular sandstone and some smooth water-worn clasts. It also contained relatively more aboriginal chert flakes than Stratum 2, especially in the eastern portion of Trench 1. Some charcoal flecks were noted in the otherwise homogeneous (10YR4/3 to 4/4) stratum and tree roots penetrated it extensively. In Trench 2 the boundary between Stratum 2 and 3 was fairly smooth and sharp while the boundary between the same strata in Trench 1 was undulating though still a sharp contrast. Stratum 3 pinched out near the western end of Trench 1, however here it was overlain by a thick disturbed deposit that may have truncated it. Toward the eastern end of the trench Stratum 3 became thicker and in the same area a line of horizontally-oriented chert flakes was noted just below the contact with the overlying Stratum 4. Also in the same area (E1020-E1030), the upper part of the stratum was penetrated by a large post mold originating in Stratum 5.

Diagnostic projectile points recovered in controlled excavations were typed primarily as Late Archaic forms. Most were from the upper 5 cm of the deposit and additional Late Archaic points came from backhoe trenching, though the provenience on the latter is not as certain. Floral and faunal preservation from this stratum was poor, suggesting the surface was exposed to the elements for some time prior to burial.

Stratum 4 was the next overbank deposit in the sequence at Area D and was also the most areally restricted. It is not present in Trench 2, 3 or the western half of Trench 1. This stratum underlies the midden portion of Stratum 5 and pinched out between Stratum 3 and 5 at about E1015 but is a consistently thick deposit from this point to the east end of the trench. Stratum 4 is a fine sand/silt deposit organically enriched by human occupation. Texturally it was the same as Stratum 3, but was slightly less clayey and darker in color (10YR3/3 to 4/3) due to the higher organic content. This stratum also had a greater density of artifacts consisting of chert flakes, ceramic sherds, animal bone, charcoal and burned clay flecks, though the density declined east of E1035. Some fire-cracked rocks were noted in the stratum and a large flat bottomed pit intruded into it from Stratum 5 at about E1022. It was also noted that snail shells identified as aquatic varieties, were present within the deposit.

Excavation into Stratum 4 showed that this deposit was created in part by an Early Woodland occupation. Diagnostic projectile points, thick grog-tempered pottery sherds, an arc of post molds originating within the stratum and floral and faunal materials were recovered from controlled excavations. Like the underlying deposit, the preservation of subsistence materials was poor and also like the underlying deposit, exposure of the surface is suggested.

The best preserved cultural stratum at 3MR80-Area D is Stratum 5. This stratum overlays Stratum 3 and 4 and was found in a thin lens in Trench 2 near the juncture with Trench 1, and from E1005 to the east end of the latter trench. The stratum was a sand/silt/clay overbank deposit of less consolidated and more clayey sediments than the underlying strata. The entire deposit was heavily penetrated by roots because of its proximity to the present surface. Stratum 5 directly overlays Stratum 3 in Trench 2 and west of E1015 in Trench 1. This latter segment of the stratum contained chert flakes, fire-cracked rocks and charcoal but was identified as nonmidden due to a relative lack of organic enhancement reflected in a lighter color (10YR3/3) when compared to the stratum east of E1015.

Stratum 5, east of E1015 conformably overlays Stratum 4 and was identified as the midden stratum defined by SPEARS. The deposit here has a much higher organic content, resulting in a darker color (10YR3/2 to 2/2), and had a platy friable structure. The stratum became thicker moving west to east and contained a dense concentration of chert flakes and tools, ceramic sherds, animal bone, mussel and aquatic snail shells, fire-cracked rocks, weathered limestone chunks, and carbonized plant remains. The most dense cultural occupation was noted between E1020 and E1030 where a large post mold and pit feature intruding into the lower strata were defined. The presence of burned clay flecks also suggests the possibility of a structure nearby. This segment, when excavated, showed a compacted living floor and midden buildup which were dated to the Middle Woodland to Early Mississippi Periods. Thus, the stratum was occupied over some time but good floral and faunal material preservation suggests that the site was not exposed continuously.

The final stratum capping the surface of the site was a natural deposit of sand deposited by the 1982 flood. This deposit was easily differentiated from the underlying cultural strata, but merged with the thick disturbed stratum at the west end of the site attributed to the last private occupation of Area D, the Fred W. Dirst canoe service.

CHAPTER 6

Archeology of 3MR80-Area D

GEORGE SABO III

Introduction

In this chapter, evidence concerning the physical characteristics of cultural deposits contained in 3MR80-Area D will be reviewed; in particular, the attributes of site structure, content, condition, and quality will be discussed, and a brief summary of the various kinds of features and artifacts found at the site is included. These data sets, along with the results of specialized analyses of archeobotanical and archeozoological remains presented in Chapters 7 and 8, are considered further in Chapters 9 and 10 with regard to the insights they furnish concerning the organization of prehistoric cultures in the lower Buffalo River Valley.

To facilitate the following discussion, it will be helpful to define a few of the more crucial terms that will be employed. Site structure refers to the overall vertical and horizontal configuration of sediments along with cultural features found within those sediments, such as living surfaces, postmold patterns, pits, hearths, and noteworthy concentrations of artifacts. Within the naturally deposited strata of an archeological site such as this one, it may be possible to identify discrete cultural strata (sediments deposited by or substantially altered as a consequence of past human activity). At 3MR80-Area D, several cultural strata were identified. The components identified and discussed in subsequent chapters of this report are analytic units representing the archeological content of discrete cultural strata.

By site content we mean the assemblage of natural and cultural materials contained within archeological sediments. Such materials could include naturally occurring pollen, plant remains, or animal remains reflecting past environmental conditions. Cultural materials--such as stone or bone tools and manufacturing debris, pottery, fire cracked rock, and the preserved remains of plant and animal food--indicate the kinds of human activities that once took place at the site. Although natural and cultural materials found in archeological sediments may be analyzed and interpreted to provide inferences concerning past lifeways and environments, it is important to note that a variety of natural and cultural processes may affect the preservation of materials at archeological sites, thus altering their content. In extreme cases, such post-depositional alterations may effectively erase all traces of past human activity. Therefore, site condition refers to the present physical state of a site. This takes into consideration the potential impacts of a host of processes affecting natural and cultural materials as they are removed from the living human ecosystem and incorporated into an archeological context. Another term, taphonomy, refers to the study of past and on-going processes affecting the content and

condition of archeological sites. These processes might include, for example, alluvial alteration of paleolandscapes in the locality, the effects of animal and insect burrowing on the spatial distribution of artifacts, and the effects of soil chemistry on the preservation of organic substances such as bone, wood, or other plant materials. Taphonomic interpretations play an important role in evaluating the physical characteristics of archeological sites.

Site Structure and Cultural Stratification at 3MR80-Area D

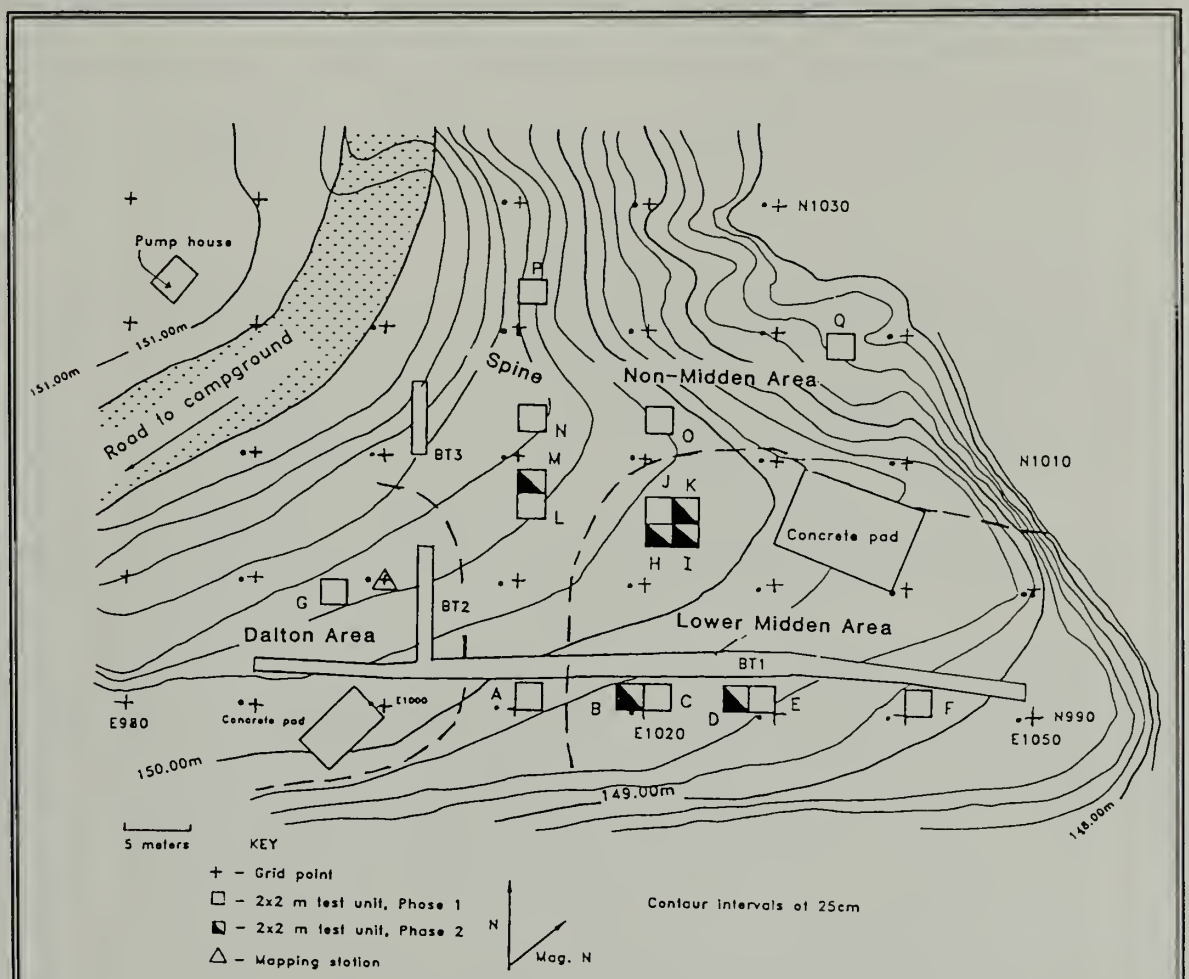
Archeological investigations at 3MR80-Area D included various field techniques: excavation of shovel tests and 50x50 cm column samples, backhoe excavation of a series of trenches, and excavation of seventeen 2x2 m test units. These excavations uncovered sufficient stratigraphic and material evidence to provide a detailed assessment of site structure. The most important result of this assessment is the definition of a series of discrete cultural strata that extend across portions of Area D. These strata contain artifacts and other materials representing a sequence of human occupations at the site dating from roughly 9,500 to 850 years ago.

The following discussion of site structure is keyed to the plan map of Area D (Figure 6-1), and the schematic profiles of Backhoe Trenches 1, 2, and 3 (Figures 6-2 and 6-3). These illustrations depict Area D as a triangular or wedge shaped segment of an upper terrace overlooking the confluence of Rush Creek and the Buffalo River. As noted in Chapter 5, this terrace is blanketed by Holocene age floodplain deposits covering more deeply buried Pleistocene age deposits. The geostratigraphy of this terrace contains a more recently developed soil profile extending down from the present ground surface, but deeper within these sediments an earlier soil horizon, called the paleosol, is also preserved.

The overall slope of Area D runs gently downhill southeast from the Rush Campground access road to the tip of land overlooking the confluence, where there is a very steep bank leading down to the water. From the road one can also walk northwest past the pump house and into the woods up a slightly steeper incline. There is a "spine" of higher ground that bisects Area D, running to the northwest past the pump house from the tip of land overlooking the confluence. The land slopes gently downhill as one moves away from this spine, both to the north and south. This topography, as will be demonstrated, is of central significance to the archeological structure of Area D.

There is a near surface occurrence of bedrock at the bottom of Backhoe Trench 3 that is blanketed by a coarse, extensively weathered lag gravel deposit labeled Stratum 1a. This bedrock was also seen in Backhoe Trenches 5 and 6, which were excavated further upslope to the northwest. Along with the overlying lag gravels, it is the subsurface geological feature that controls the surface topography of Area D and accounts for the northwest to southeast trending "spine" of higher ground bisecting this landform.

Examination of wall profiles in Backhoe Trenches 1, 2, and 3 and in the 2x2 m test units indicates that the two portions of Area D, located respectively to the north and south of the central spine, were subject to differ-



A = N990/E1010
B = N990/E1018
C = N990/E1020
D = N990/E1026
E = N990 =E1028
F = N990 =E1040
G = N998/E995
H = N1003/E1020
I = N1003/E1022
J = N1005/E1020
K = N1005/E1022
L = 1005/E1010
M = N1007/E1010
N = N1012/E1010
O = N1012/E1020
P = N1022/E1010
Q = N1018/E1034

Figure 6-1. Map of 3MR80-Area D, showing archeological excavations, nonmidden area, lower midden area, and Dalton area.

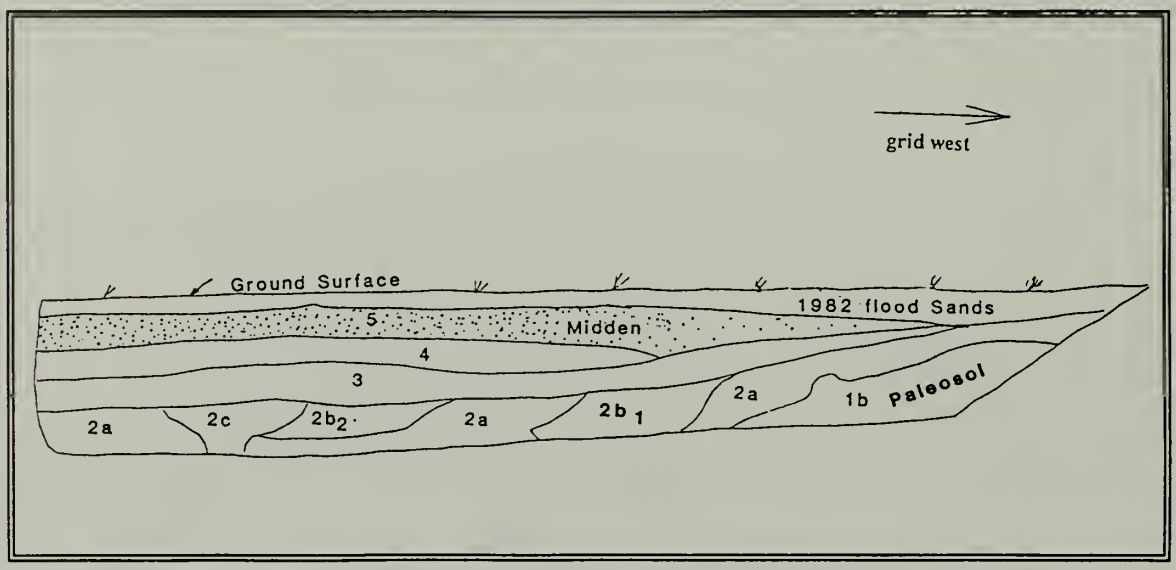


Figure 6-2. Schematic profile of south wall of Backhoe Trench 1, 3MR80-Area D (not to scale).

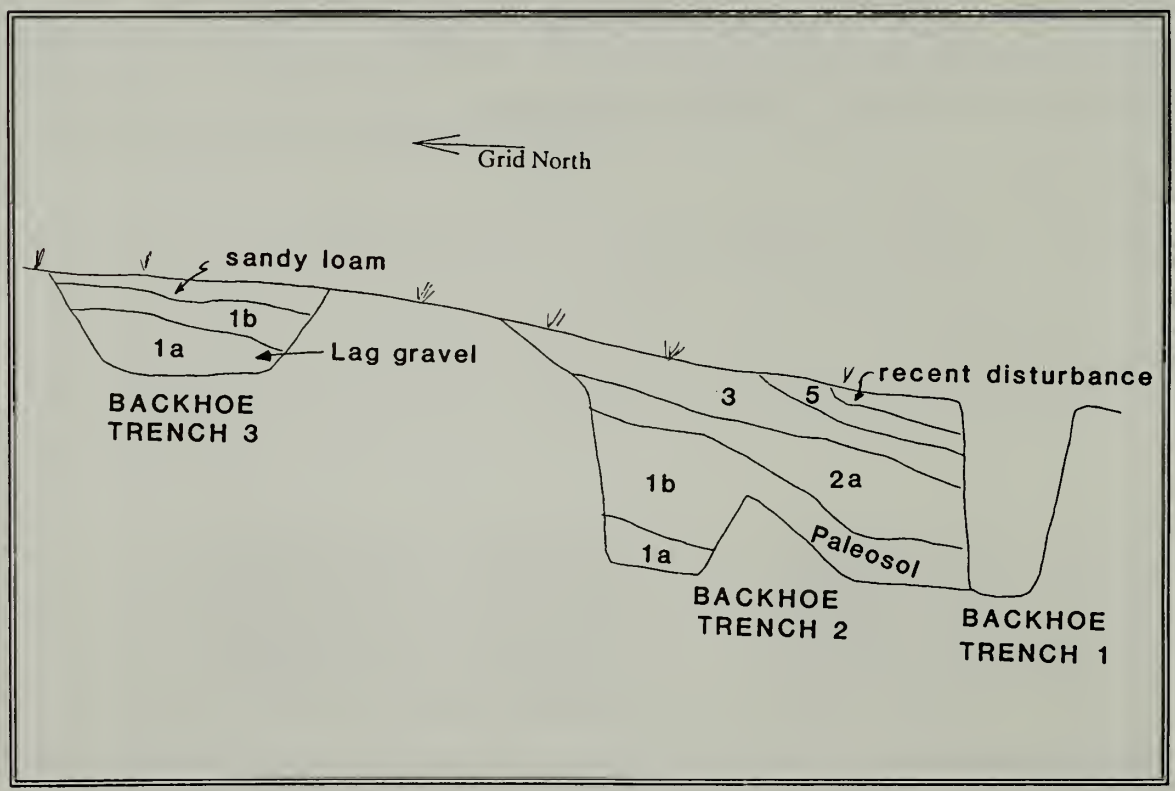


Figure 6-3. Schematic profiles of east walls of Backhoe Trench 2 and 3, 3MR80-Area D (not to scale).

ent cycles of sedimentary deposition and erosion. These cycles, in turn, affected both the horizontal and vertical configuration of cultural deposits present within different portions of Area D. To facilitate discussion of the resulting archeological structure, three subunits of Area D are identified: 1) the nonmidden area, 2) the lower midden area, and 3) the Dalton area. These areas are indicated on Figure 6-1. The grid location of each unit is the southwest corner stake, a standard datum notation on all Arkansas Archeological Survey excavations. Cardinal direction references are oriented to grid north.

Nonmidden Area

Six 2x2 m test units were excavated in the northern portion of Area D. This area slopes downhill to the northeast from the central "spine" as you walk toward Rush Creek. In the test units closest to the road, lag gravels were encountered at depths of only a few centimeters, whereas in the units closer to Rush Creek excavations reaching depths below 1.5 m were still in alluvial sediments. In none of these units, however, was a midden deposit encountered. A brief description of the stratigraphy of each test unit in the nonmidden portion of Area D is presented below, followed by general interpretations for this part of the site.

N1005/E1010 and N1007/E1010

Recent flood sands were removed to a depth of 19 cm below the surface in N1005/ E1010, at which point an undisturbed sandy loam A horizon was encountered. Two excavation levels into this horizon were removed. As these levels were excavated, an area of slightly disturbed sediments extending out across the floor from the north wall of this unit resolved into a clearly delineated anomaly at a depth of 40 cm. This anomaly, designated Feature 7, consisted of an area of mixed orange clays and organic stains that provided a striking contrast against the homogeneous sandy loam that extended across the rest of the unit at this depth.

In order to further investigate this anomaly, excavations were opened in the adjacent unit to the north, N1007/E1010. A single level was excavated to a depth of 40 cm below the surface. Examination at this point of the wall profiles in the balk separating the two excavation units clearly indicated that the anomaly was the result of an old tree fall. Large root casts were visible as organic stains, observed both in plan and profile views (Figures 6-4 and 6-5). Orange clays adhering to the roots had been brought closer to the surface as the tree had fallen over.

After the investigation of Feature 7 had been concluded, the northern half of N1005/E1010 was excavated to a final depth of 1.1 m below the surface (Figure 6-6). The compact silty clay, Stratum 1b, was encountered at 60 cm below the surface. Unfortunately, no diagnostic artifacts were found in this stratum. In the overlying sandy loam A horizon, basal fragments of two Smith points and a basal fragment of a Table Rock Stemmed point were found. Both of these point types date to the Late Archaic period. A pitted stone fragment and an adze were also collected from the sandy loam stratum, in addition to preform fragments, cores, and flakes.

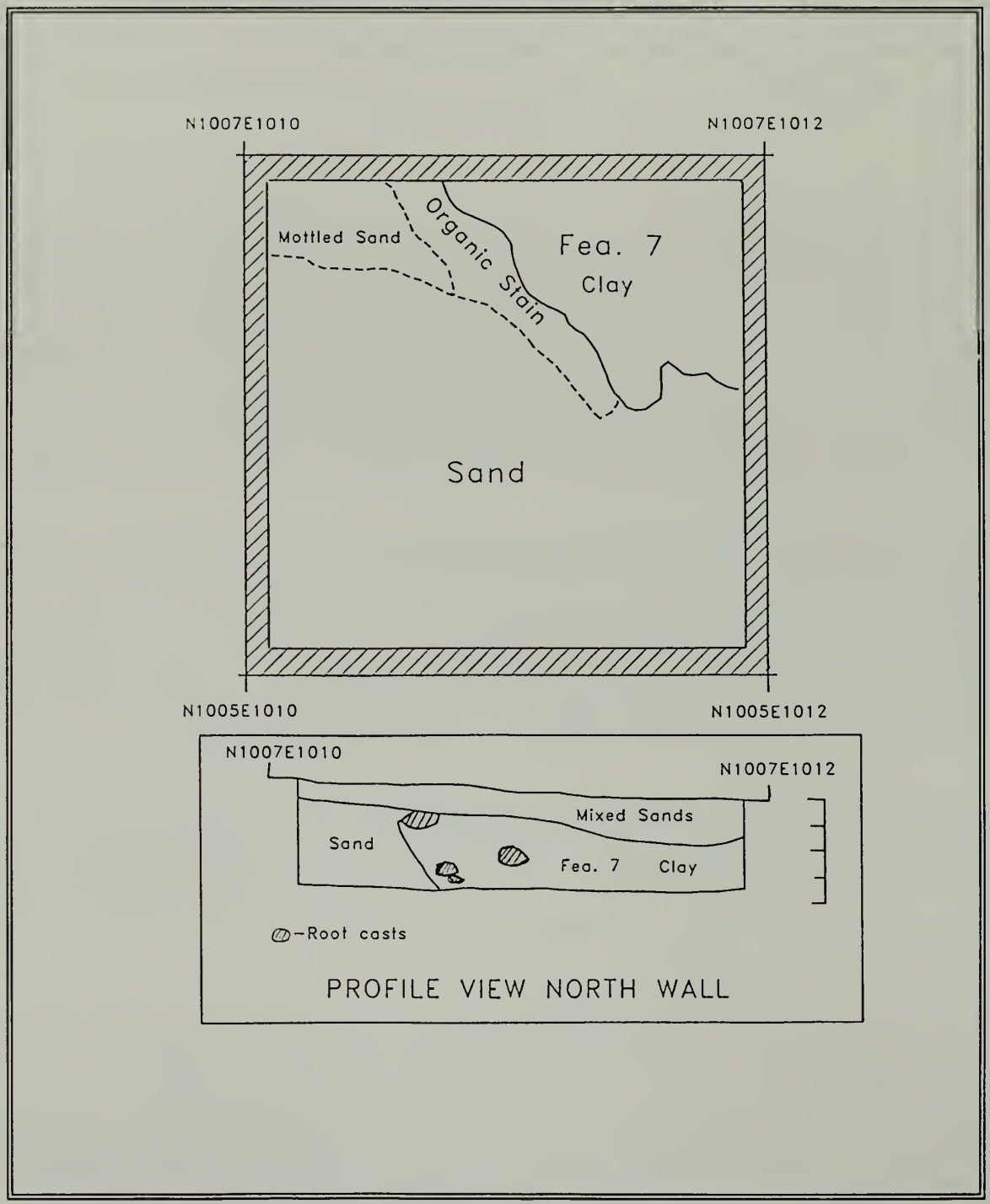


Figure 6-4. 3MR80-Area D, plan and profile of Feature 7. Elevation of N1007/E1010 stake = 150.53 m.

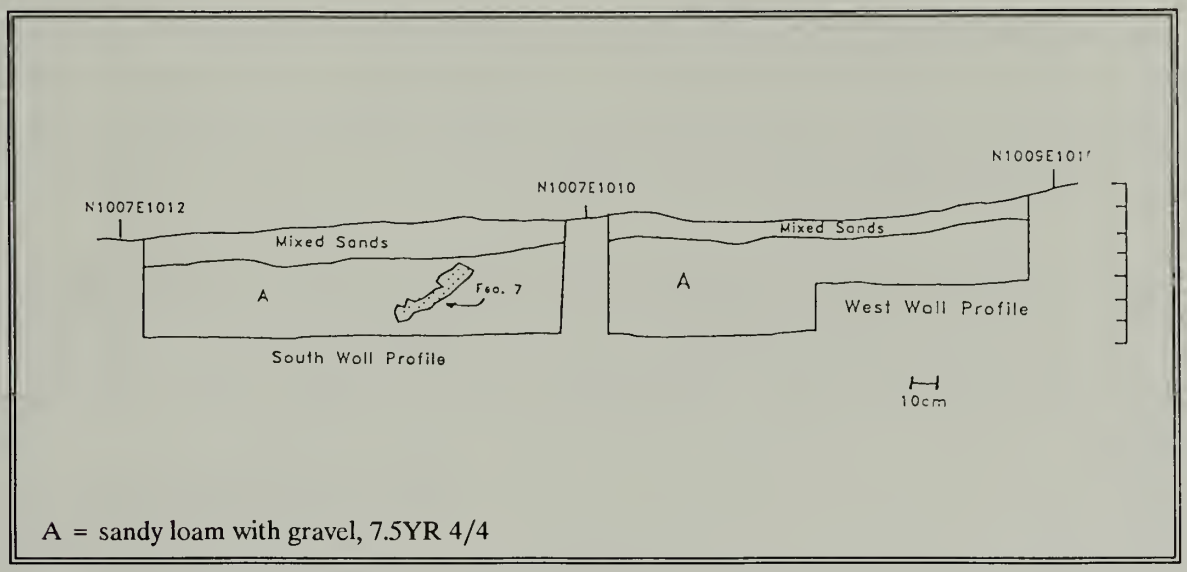


Figure 6-5. 3MR80, south and east wall profiles of Unit N1007/E1010. Elevation of N1007/E1010 stake = 150.55 m.

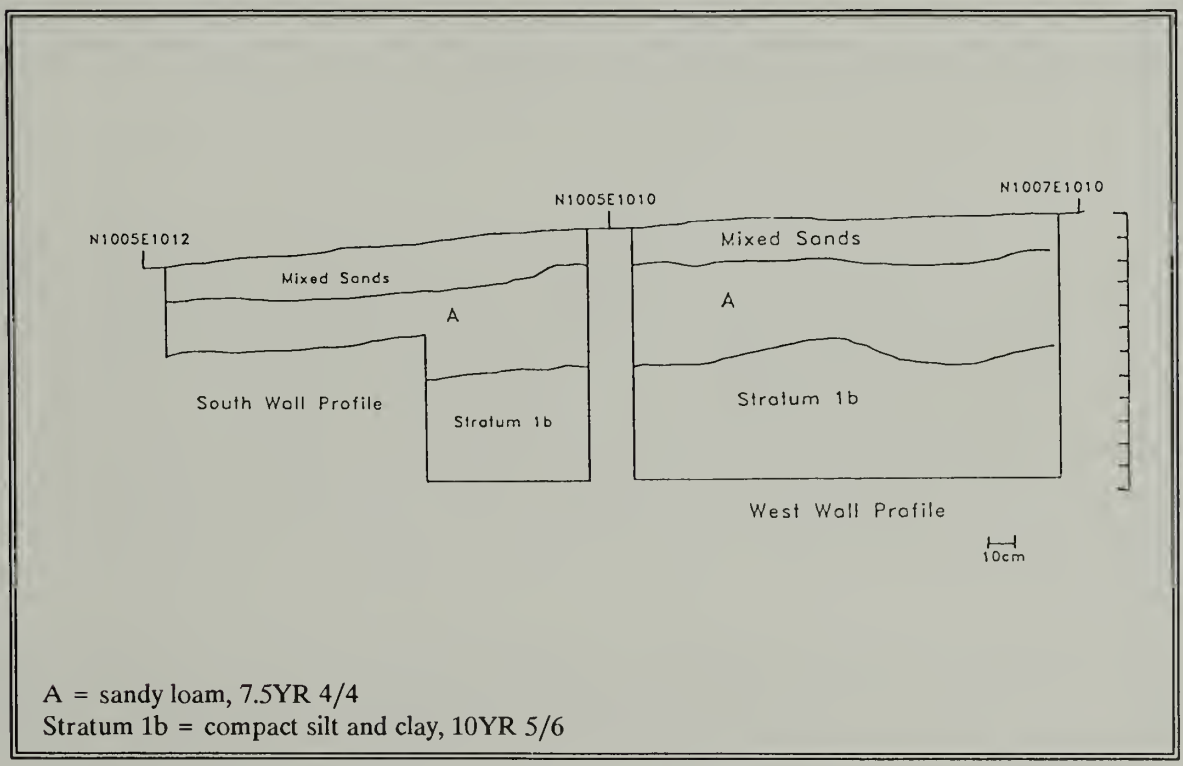


Figure 6-6. 3MR80, south and west profile of Unit N1005/E1010. Elevation of N1005/E1010 stake = 150.34 m.

N1012/E1010

Disturbed surface sediments and mixed flood sands were first removed to a depth of 15 cm in this unit. Subsequent levels were excavated through a sandy loam A horizon to a depth of 40 cm, at which point Stratum 1a lag gravels were encountered. Since chert flakes were abundant at the base of the A horizon, a 1x1 m area in the southwest corner of the unit was excavated another 10 cm into the gravel (Figure 6-7). At this level, the amount of chert flakes dropped sharply.

Artifacts found in the A horizon of this unit included fragments of a Middle to Late Woodland period Rice Side Notched point, a Middle to Late Archaic Williams point, and an Early to Middle Archaic Big Sandy point. The co-occurrence of these artifacts within a single 10 cm level of this stratum clearly indicates mixing of temporally distinct cultural materials. In addition to these items, cores, flakes, and biface fragments were also found.

N1022/E1010

In this unit, mixed flood sands at the present ground surface extend directly to Stratum 1a lag gravels, which occur in this portion of Area D at a depth of only 10 cm (Figure 6-8). The sandy loam A horizon identified in the previously described units had been completely eroded from this part of the site. Even though the excavations in this unit were terminated at a depth of 20 cm, an impressive amount of artifacts were collected, including an adze, several fragments of points and other bifaces, preforms, cores, and flakes.

N1012/E1020

In this unit a sandy loam A horizon extended from the base of flood sands at the surface to a depth of approximately 40 cm. Below this a compact silty clay occurred that appeared very similar to Stratum 2b sediments identified in the backhoe trenches. At the contact between the A horizon and Stratum 2b, a semi-circular area extended from the south wall of the unit within which softer, less consolidated sediments were noted. This anomaly continued through the next two excavation levels. In an effort to ascertain the nature of this anomaly, a 1x1 m section in the southeastern corner of this unit was excavated to a depth of 90 cm below the surface. In the south wall profile of this unit (Figure 6-9), the anomaly appeared to be a broad, shallow basin. Apart from a slight difference in color from the surrounding sediments, no additional distinguishing features could be discerned.

Artifacts found in the A horizon of this unit included several small potsherds, cores, flakes, two arrow points, a knife, and fragments of dart points and other finished bifaces and preforms. Two biface fragments and a small corner notched dart point, similar to the Middle Archaic Frio type, were collected from the Stratum 2b sediments.

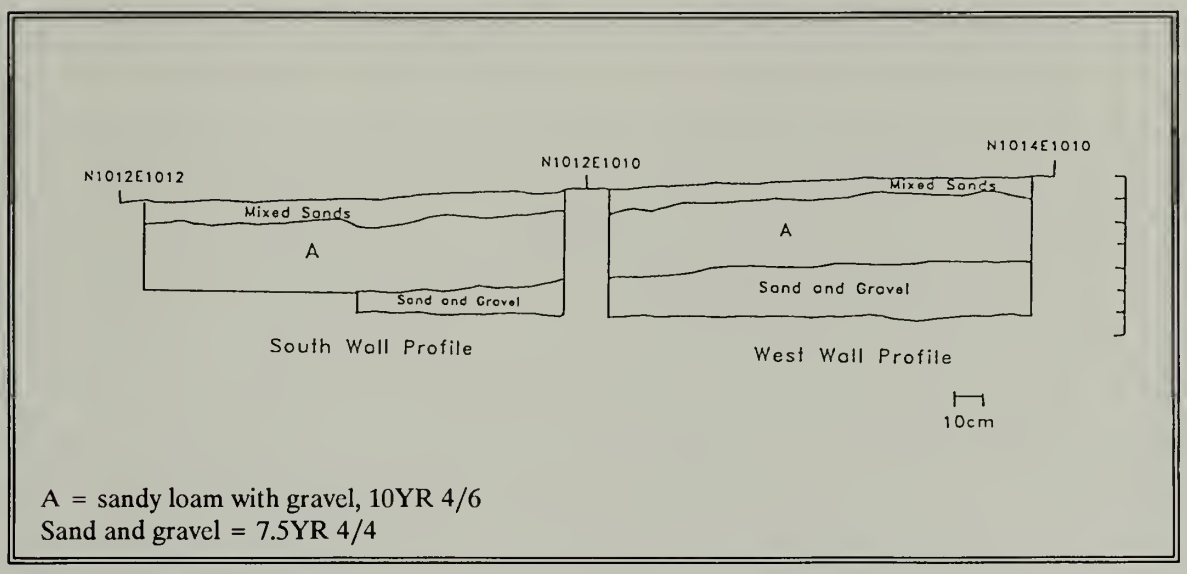


Figure 6-7. 3MR80-Area D, south and west wall profiles of Unit N1012/E1010. Elevation of N1012/E1010 stake = 150.85 m.

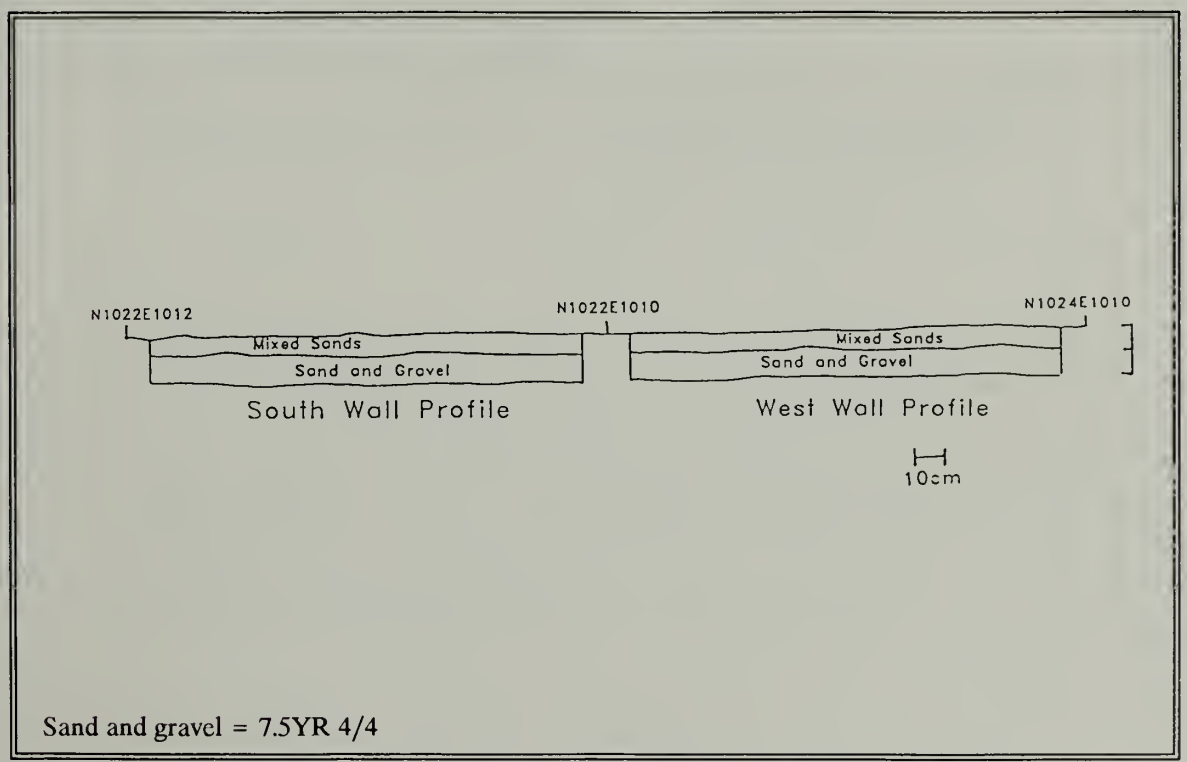


Figure 6-8. 3MR80-Area D, south and west profiles of Unit N1022/E1010. Elevation of N1022/E1010 stake = 150.77 m.

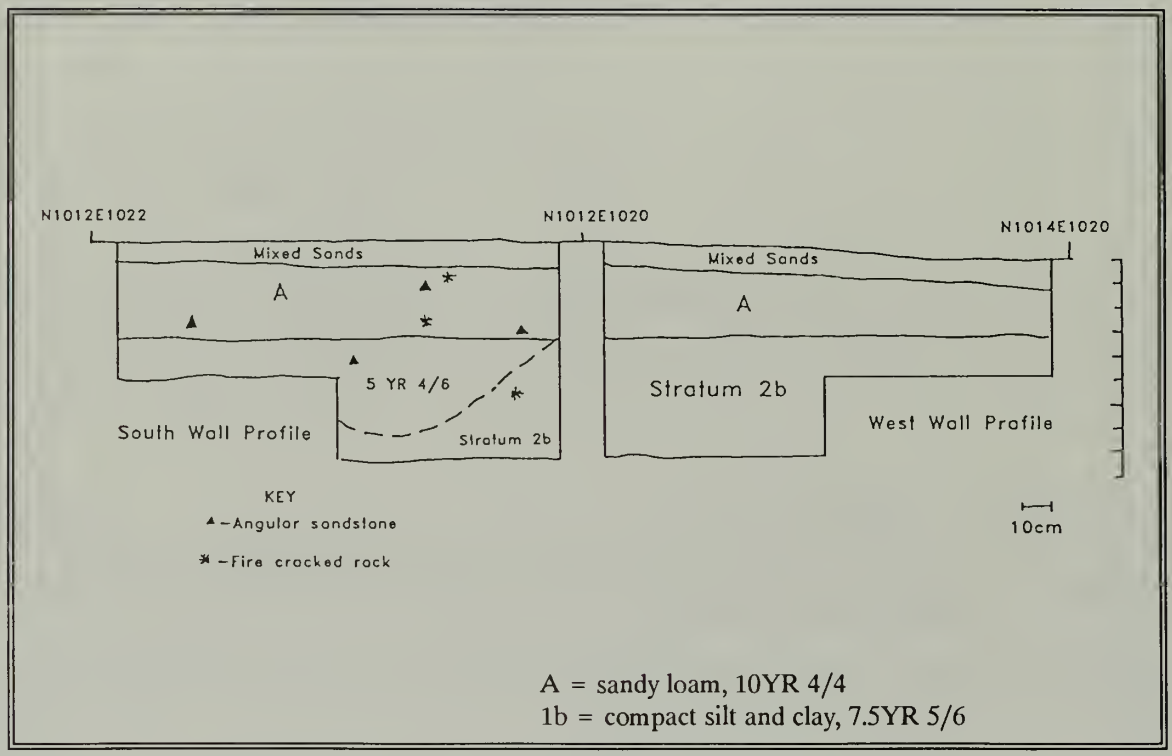


Figure 6-9. 3MR80-Area D, south and west profiles of Unit N1012/E1020. Elevation of N1012/E1020 stake = 150.34 m.

N1018/E1034

This unit was placed in a low swale near the northeastern edge of Area D. Here, mixed flood sands graded without a clear boundary into the underlying sandy loam (Figure 6-10). The base of a Late Woodland Gary *var. Camden* dart point and a core fragment were found in the sandy loam horizon. Below the sandy loam, a reddish sandy clay stratum was encountered that extended from approximately 25 cm to 80 cm below the surface. This stratum contained only a few flakes and an occasional chert biface fragment. In texture and color this sediment corresponded most closely to Stratum 2a, identified in the backhoe trenches. A compact sandy clay stratum, somewhat lighter in color and resembling Stratum 1b in the backhoe trenches, extended from about 80 cm to the terminal excavation depth of 1.5 m. No artifacts were collected from this stratum.

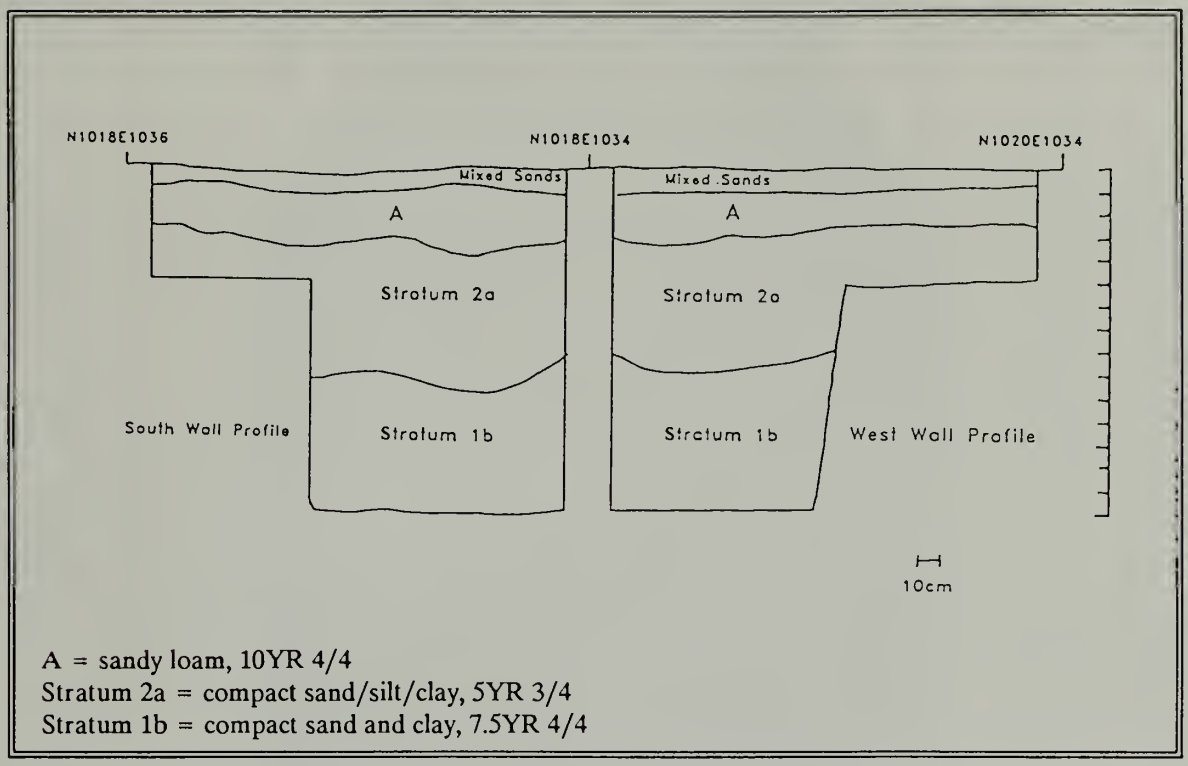


Figure 6-10. 3MR80-Area D, south and west profiles of Unit N1018/E1034. Elevation of N1018/E1034 stake = 148.31 m.

Summary of the Nonmidden Area

The six test units described above were all located on the northern side of the "spine" bisecting Area D. The stratigraphy noted for these units indicates that in the upslope area, closest to the road, overall erosion of sediments has occurred to such an extent that only a thin stratum of sandy loam now covers the underlying late Pleistocene age lag gravels. Artifacts associated with this sandy loam represent several temporally distinct occupations ranging from Early Archaic to Late Woodland times, though no stratigraphic separation of these materials could be discerned. The deeper accumulation of sediments in the downslope portion of this area, as observed in N1018/E1034, indicates that at least some of the sediments eroded from upslope were captured here. However, the artifacts collected from this low-lying area were so few that it must not have been a significant prehistoric activity area. The most likely interpretation for the nonmidden portion of Area D is that as cultural materials were deposited in the upslope area near the road, the rate of sedimentary erosion was such that stratigraphic separation of temporally successive cultural materials did not occur. Instead, artifacts were incorporated into deflating sediments already containing materials from earlier occupations. Although we collected a substantial number of artifacts from the test units excavated in this area, the impracticability of

isolating whole assemblages from discrete occupational horizons severely compromised the value of these artifacts for analytic purposes. Consequently, the cultural materials from this part of the site will not be further considered.

Lower Midden Area

Shovel testing on a 10 m grid across the entire extent of Area D gave indications that the midden reported in the SPEARS 1986 testing report was confined to the easternmost half of Area D (Appendix 5 lists the artifact inventory for these shovel tests). This is the area within which SPEARS excavated two short backhoe trenches. These indications were confirmed by a more extensive program of backhoe trenching and the excavation of 2x2 m test units. By the end of our fieldwork, nine test units had been excavated at least to the base of the Stratum 5 midden. One additional unit (N990/1010) was excavated in an area where the midden character of Stratum 5 changed to an enhanced A horizon. These ten units are discussed here as the "lower midden area," in order to distinguish it from another midden deposit that was encountered during the excavation of a geological test trench (Backhoe Trench 4) in the higher ground to the west of the road behind the pump house. This latter midden is referred to as the "upper midden." Excavations were conducted in the upper midden area to salvage a pit feature (Feature 8) exposed by the backhoe trenching. Analysis of this material will be supported internally by the Arkansas Archeological Survey, and a separate report by Guendling and Sabo will be prepared to summarize the data and interpretations from that part of the site.

N1003/E1020, N1003/E1022, N1005/E1020, N1005/E1022

Excavations in the lower midden area were begun in N1005/E1020. Removal of approximately 10 cm of mixed sands in this unit was followed by excavation through the Stratum 5 midden to a depth of 40 cm. At this level, a compacted surface was encountered that was littered with rounded sandstone cobbles, fire cracked rock, and horizontally oriented artifacts. This surface was designated as Feature 5, but it is convenient to refer to it as the Stratum 5 "living floor." A large pit, Feature 4, also originated at this surface, extending out from the eastern edge of the unit. In order to fully expose this feature, the adjacent unit N1005/E1022 was opened up and the midden stratum was excavated as a single 40 cm level (although standard flotation samples were collected at 10 cm intervals). At a depth of 40 cm the rock strewn living floor was encountered in N1005/E1022 (Figure 6-11). To gain an even greater exposure of the living floor in the hope of finding additional features, units N1003/E1020 and N1003/E1022 were opened. Both were excavated to the living floor. A single 41 cm level was excavated in N1003/E1020 (with standard flotation samples collected every 10 cm), and N1003/E1022 was excavated in a series of 10 cm levels to 40 cm below the surface. No additional features were encountered in these two units (Figure 6-12).

With the entire 4x4 m block excavated to the rock strewn living floor, investigation of Feature 4 was undertaken. First, the west half of the feature was removed, revealing a profile indicating that the feature was

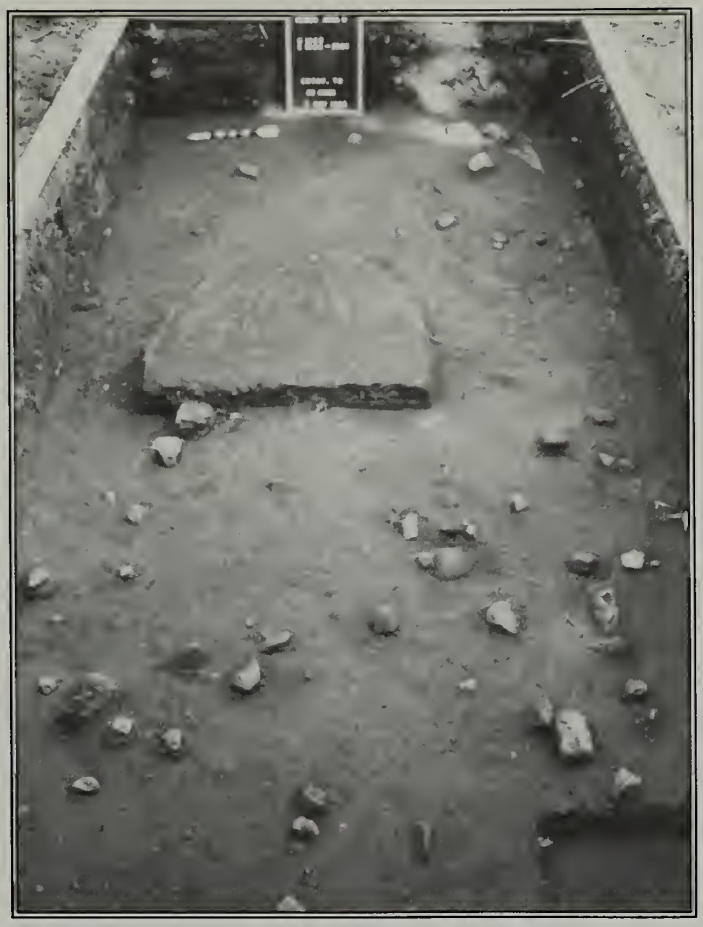


Figure 6-11. Feature 4 and rock strewn living floor (unexcavated) in N1005/E1020 and N1005/E1022 at 40 cm below surface (AAS Neg. #885875).

indeed a large basin-shaped pit slightly more than a meter in diameter and about a half meter deep (Figures 6-13 and 6-14). The pit had been filled to about two-thirds of its volume with mixed refuse, then topped with a layer of mussel shells and river snail shells before a final layer of refuse was added.

Following the excavation of Feature 4, the living floor across the entire 4x4 m block was excavated as a 5 cm level (Fig. 6-15). Each of the four 2x2 m test units was subdivided into sixteen 50x50 cm excavation grids for tighter provenience control.

The decision was made to continue excavations in one of the units within the 4x4 m block, N1003/E1020, in order to sample more deeply buried sediments (Figures 6-16 and 6-17). In that unit, Stratum 4, an anthropic sandy loam, was identified below the living floor extending to a depth of about 60 cm. Although this sedi-

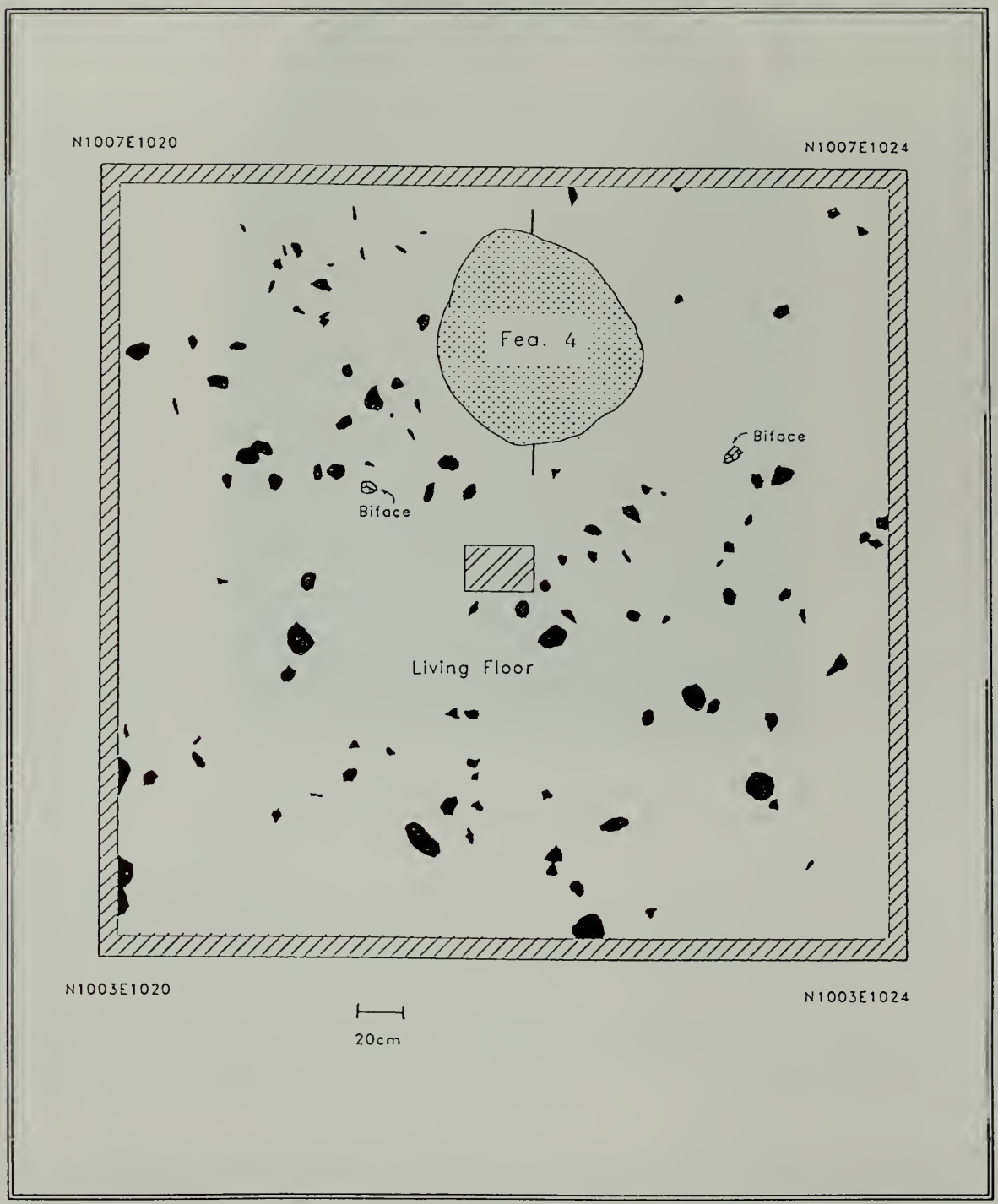


Figure 6-12. Plan map of excavations in the 4x4 m block at 40 cm below surface, showing rock strewn living floor and Feature 4. Note orientation of Feature 4 profile.



Figure 6-13. East profile of Feature 4 showing shell layer in fill (AAS Neg. #886190).

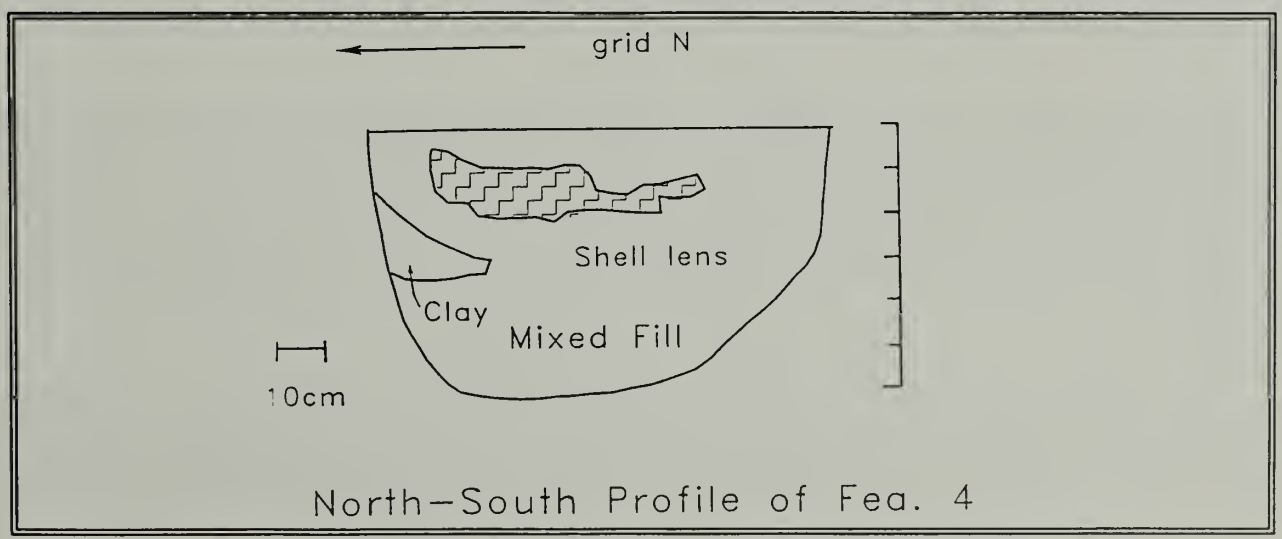


Figure 6-14. 3MR80-Area D, north-south profile of Feature 4. Elevation of top of Feature 4 - 149.93 m.



Figure 6-15. 4x4 m block area after excavation of Feature 4 and rock strewn living surface (AAS Neg. #886171).

ment could be characterized as a midden, it was neither as dark nor as prolific of cultural materials as the overlying midden in Stratum 5. However, a Late Archaic Afton point was found in this stratum. Next, a fine sandy sediment, also containing cultural materials, was identified and designated as Stratum 3. This stratum extended from approximately 60 cm to 85 cm. This was in turn underlain by a compact sand and silt sediment identified as Stratum 2a. This stratum graded without a sharp boundary into the underlying clayey Stratum 1b, between 95 cm and 1.05 m. Excavations into Stratum 1b terminated at 1.15 m below the ground surface.

An extensive assemblage of artifacts was recovered from the midden and living floor in the 4x4 m block excavation. Chipped stone artifacts and manufacturing debris were abundant, as were ceramic sherds, animal bone refuse, mussel shells, and fire cracked rock. A few ground stone artifacts were found, and carbonized

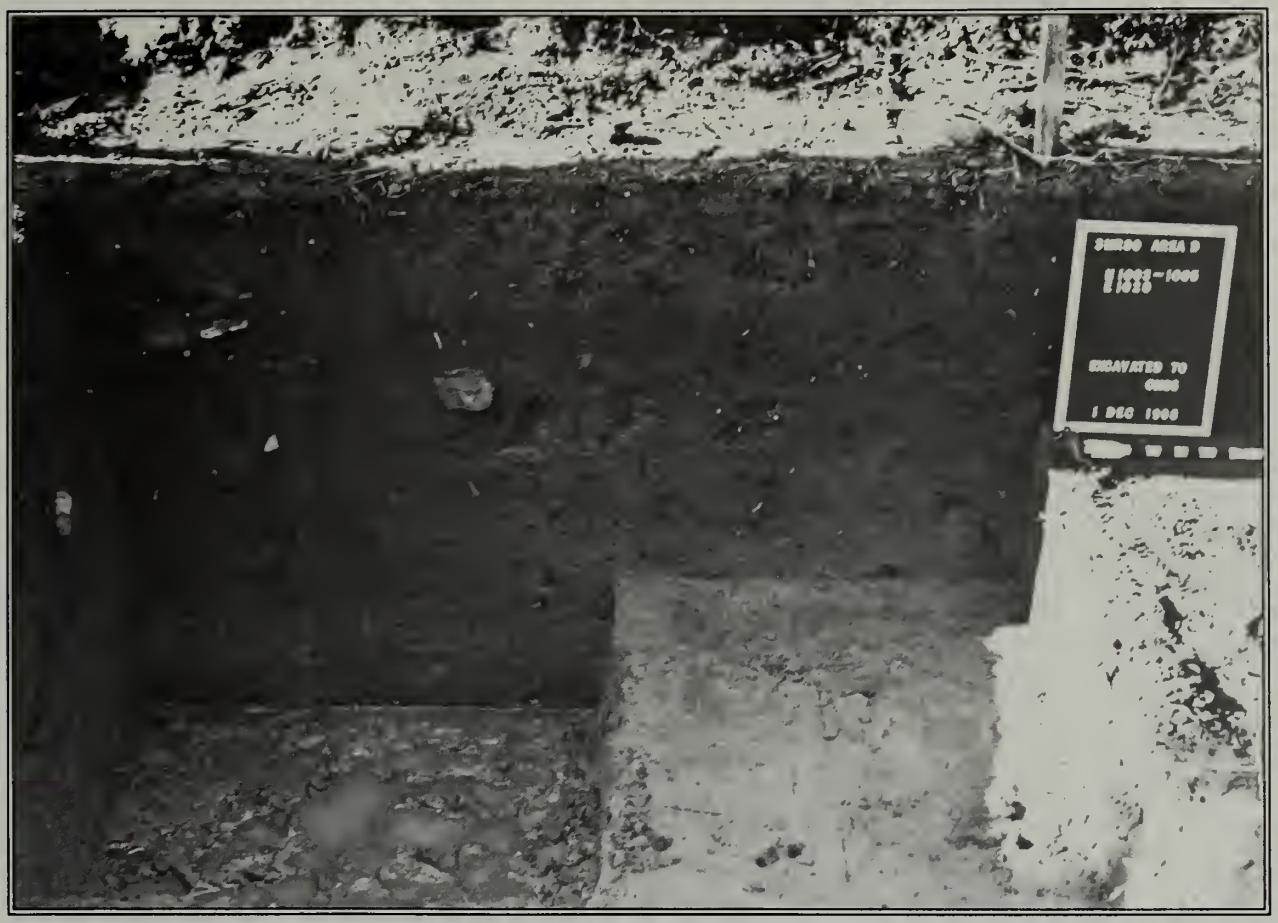
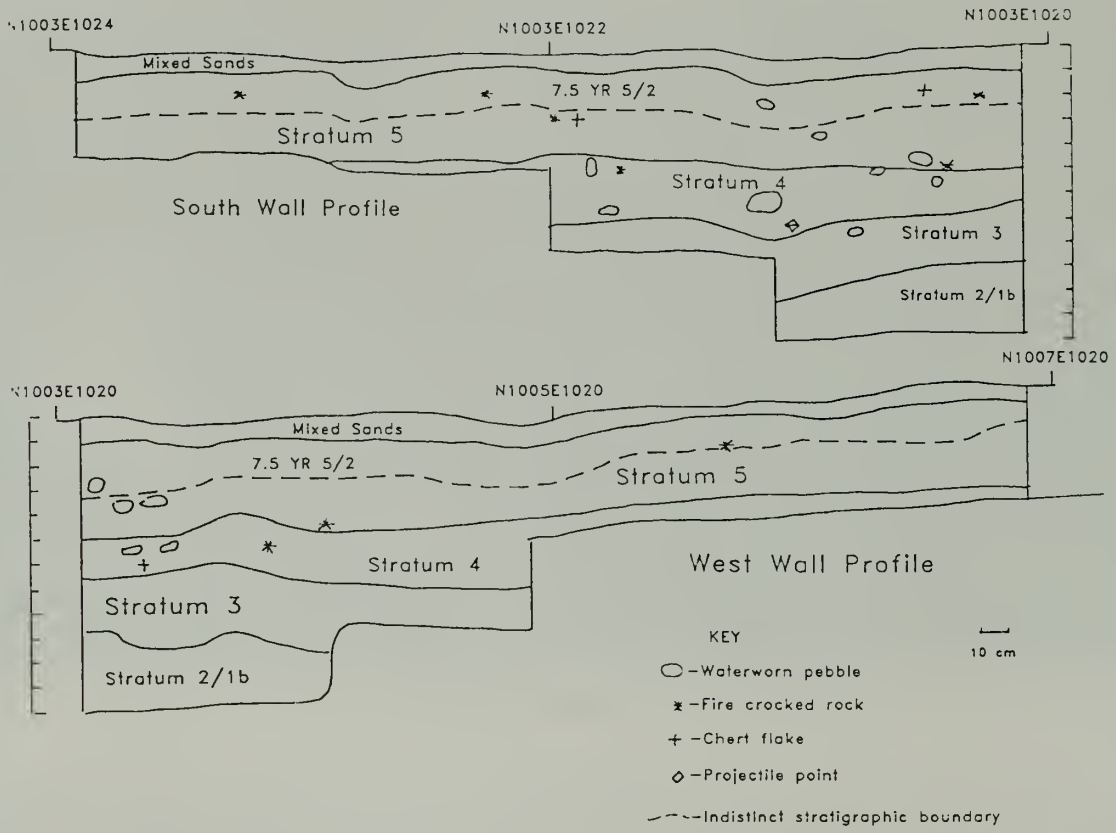


Figure 6-16. West wall profile of N1003/E1020 to N1005/E1020 (AAS Neg. #886314).

plant remains were also collected from the water flotation samples, especially from the fill of Feature 4. Among the temporally diagnostic items associated with the midden, there appeared to be a predominate assemblage consisting of Rice Side Notched dart points, Scallorn arrow points, and undecorated shell tempered pottery. This assemblage was represented consistently throughout the midden, in the Feature 4 pit, and, to a somewhat lesser degree, on the surface of the living floor, indicating that these three archeological contexts are temporally equivalent.

Finally, it should be noted that a few small fragments of human bone were found in the midden sediments in this 4x4 m excavation, including the fill of Feature 4. All of these remains were unquestionably in a secondary context of deposition--absolutely no indications of intentional interment were recognized. It is not possible at the present time to determine the cultural affiliation of these remains.



Stratum 2/1b = compact silt, 7.5YR 5/6
Stratum 3 = sand/silt, 7.5YR 4/4
Strutum 4 = sand/silt, 7.5YR 3/2
Stratum 5 = sand/silt, midden, 10 YR 2/1

Figure 6-17. 3MR80-Area D, south and west profile walls of Units N1003/E1020, N1003/E1022, N1005/E1020, N1005/E1022. Elevation of N1003/E1020 stake = 150.34 m.

N990/E1018 and N990/E1020

The midden in these units on the south side of Backhoe Trench 1 extended for approximately 25 cm from the base of the mixed flood sands. Just below the flood sands in N990/E1020, a very hard surface, measuring about 35 cm in diameter, was noted extending from the balk separating this unit from N990/E1018. Designated as Feature 6, this hardened sediment, we learned later, was the result of a recent disposal of a lime solution into the ground.

At the base of the midden, the rock-strewn living floor was encountered in both of these units. As in the 4x4 m block, the living floor in these two units was excavated as a 5 cm level in 50x50 cm grids. The midden and living floor in these units produced an artifact assemblage that was basically the same as that found in the equivalent strata of the 4x4 m block excavation. Two additional levels were excavated into Stratum 4 in N990/E1020 (Figure 6-18). Stratum 4 in this unit was lighter in color than Stratum 5, and it contained fewer cultural materials. The temporally diagnostic artifacts from Stratum 4 in this unit suggested an earlier date of occupation than that of Stratum 5. Although one shell tempered potsherd was found immediately below the living floor, two thick, grog tempered sherds were collected in the deepest level excavated into Stratum 4. These sherds, along with a Langtry dart point, suggest that the Stratum 4 occupation could represent an Early Woodland

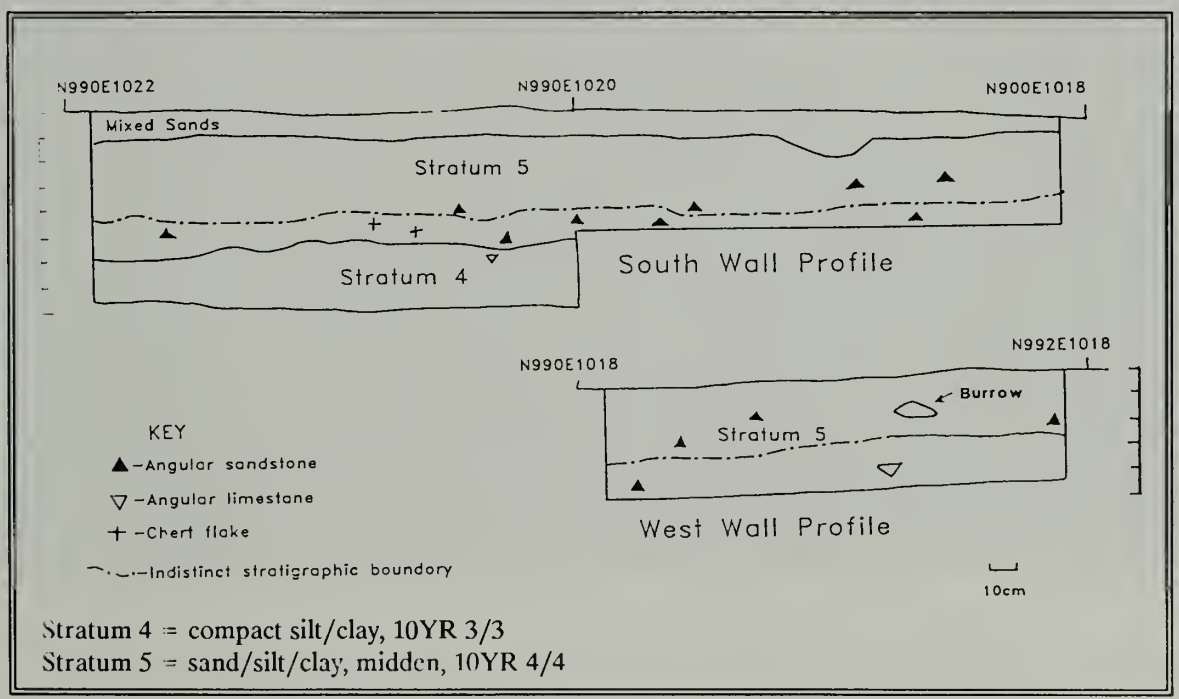


Figure 6-18. 3MR80-Area D, south and west wall profiles of Unit N990/E1018. Elevation of N990/E1018 stake = 149.86 m.

component. An Early to Middle Archaic Big Sandy point found in the lowest excavation level of Stratum 4 was most likely displaced from a lower stratum.

N990/E1026 and N990/E1028

Here, as in the test units just described, the midden extended some 25 to 30 cm below the base of the mixed flood sands. In N990/E1026, however, a portion of the midden extending out into the unit from the northern wall was somewhat darker in color and contained a particularly abundant number of artifacts, bone, shell, fire-cracked rock, and charcoal. Extending into the northeastern corner of N990/E1028, this area was designated Feature 2 (Figure 6-19). In excavating this feature, sediments from the distinguishable "core" of the feature were removed as a flotation sample, but the artifacts were not separated from the materials collected in



Figure 6-19. Feature 2 in N990/E1026 (note mislabeled menu board) exposed at 39 cm below surface (AAS Neg. #886178).

the general excavation levels. Examination of plan and profile views of this feature (Figure 6-20) reveals a shallow basin extending from roughly 25 cm to 40 cm below the surface. The bottom of this basin is above the rock strewn living floor. The occurrence within this feature of a greater amount of small, fire-baked clay nodules than in the surrounding sediments suggests that it may be the edge of a burned and collapsed house or other structure. If this is correct, additional features representing this structure might exist on the opposite side of Backhoe Trench 1. At one point plans were made to open one or two test units in that area, but time and adverse weather conditions did not permit. One large postmold was bisected during the excavation of the backhoe trench across this part of the site, but no other house features were noted.

To the east of Feature 2, and at approximately the same stratigraphic level in N990/E1028, a shallow depression was encountered that was designated Feature 3 (Figure 6-20). This pit contained an accumulation of fire cracked rock, bone, shell, and several artifacts. It is interpreted as a refuse-filled pit.

The living floor was identified in both of these units at depths of 40 to 43 cm (Figure 6-21). This surface was excavated as a 5 cm level in 50x50 cm grids in N990/E1026 only. In N990/E1028, one of the first units excavated on the site, the living floor was taken up in a standard 10 cm level.

Two additional 5 cm levels were excavated into Stratum 4 (Figure 6-22). At a depth of approximately 50 cm in N990/E1026 and 53 centimeters in N990/E1028, five small, circular organic stains were uncovered, forming a broad arc (Figures 6-23 and 6-24). Four of the stains were positively identified as postmolds. The fifth stain had been intersected by a rodent burrow, so that it was not possible to discern its original shape and orientation. This arc of postmolds quite possibly represents a house frame or some other structure, and its presence in the Early Woodland component of Stratum 4 is tremendously significant, since no other house patterns of that age have been excavated in the Ozark region. Projection of the arc indicated that it would be necessary to open up at least four, and probably as many as six, additional 2x2 m test units to fully expose its extent. Since this feature was discovered rather late in the field session, it was decided not to attempt such an undertaking at that time.

N990/E1040

This unit near the southeastern corner of Area D was excavated only to the base of the midden at a depth of 43 cm below the surface (Figure 6-25). The rock strewn living floor was not encountered in this unit. Although the midden layer in Stratum 5 still retained its pronounced dark color and characteristic texture, fewer cultural materials were found here than in the other units excavated in the lower midden area.

N990/E1010

This unit was placed to the south of Backhoe Trench 1 in an area where the midden in Stratum 5 changed to an enhanced A horizon. Although cultural materials still were abundant in this part of the site, Stratum 5

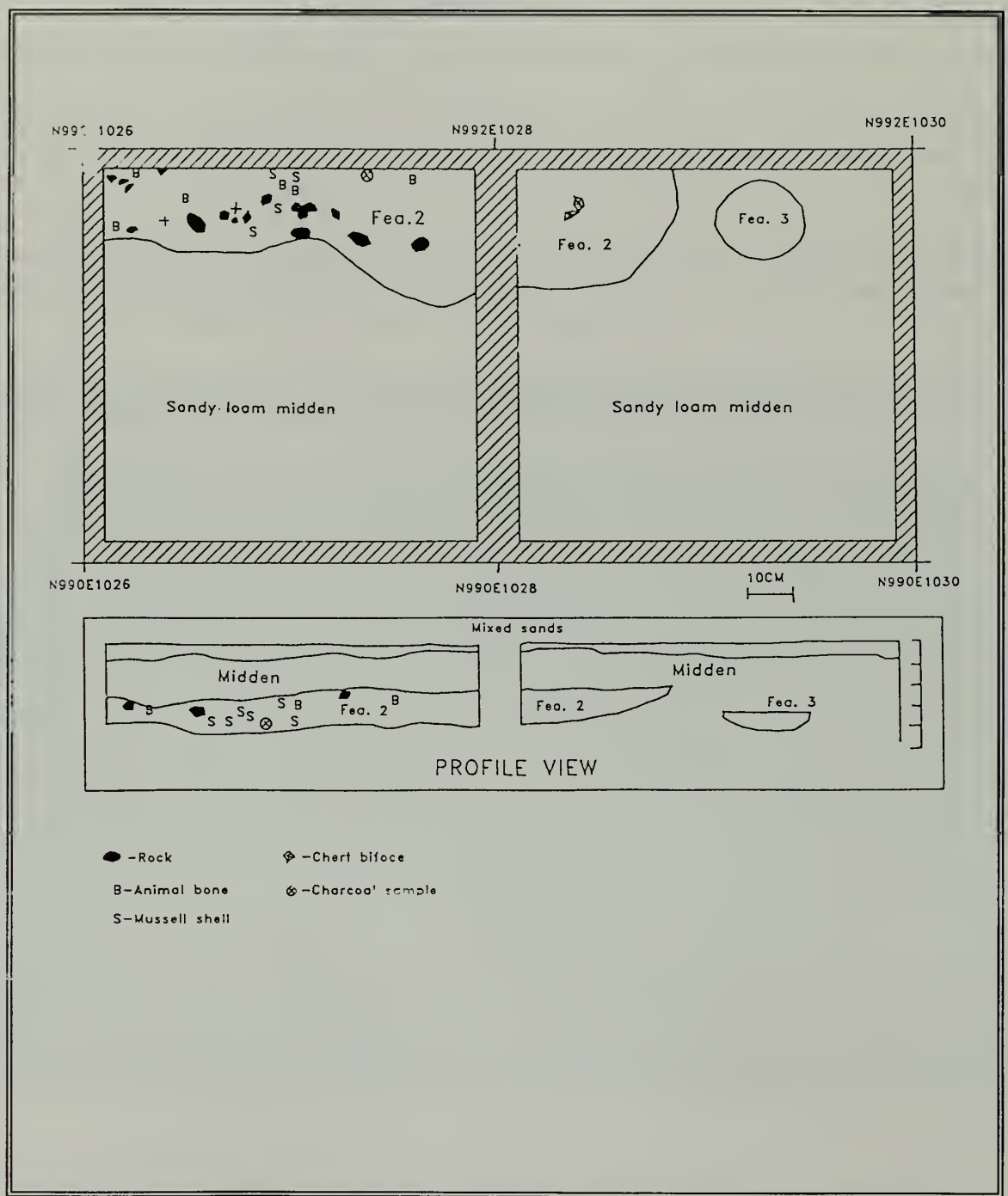


Figure 6-20. 3MR80, Area D, plan and profiles of Features 2 and 3 in N990/E1026 and N990/E1028. General elevation for top of Feature 2 = 149.30. Elevation for top of Feature 3 = 149.22.

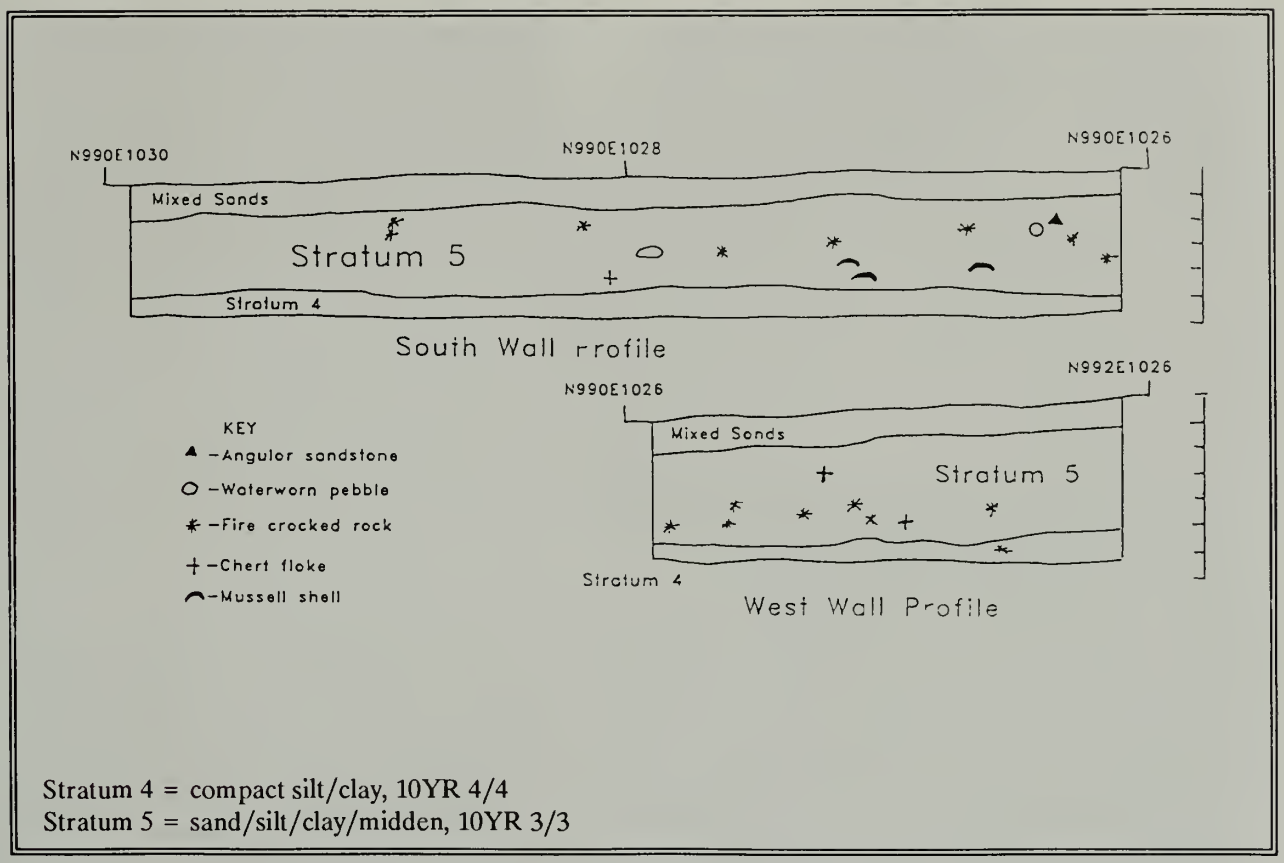


Figure 6-21. 3MR80, Area D, south and west wall profiles of Unit N990/E1026. Elevation of N990/E1026 stake = 149.55 m.

here lacked the characteristic dark, organic midden sediment that extended across much of the southeastern corner of Area D.

Below the surface in this unit, extensively disturbed sediments were encountered to a depth of about 35 cm (Figure 6-26). It is quite likely that this disturbance resulted from the construction of a concrete building pad just a few meters to the west. From 35 cm to 50 cm, Stratum 5 was identifiable as a buried sand/silt A horizon containing essentially the same kinds of artifacts that were found in Stratum 5 of the units excavated in the midden area of the site. Directly below Stratum 5, and extending from 50 cm to about 80 cm, was Stratum 3, consisting of sandy clay. Artifacts found in this stratum include a large, burinated square stemmed point base and a Castroville point. Both of these artifacts date to the Middle or Late Archaic period.

Continued excavation in a 1x1 m corner of this unit reached the compact silts of Stratum 2b1, but, unfortunately, no diagnostic artifacts were found in this stratum.

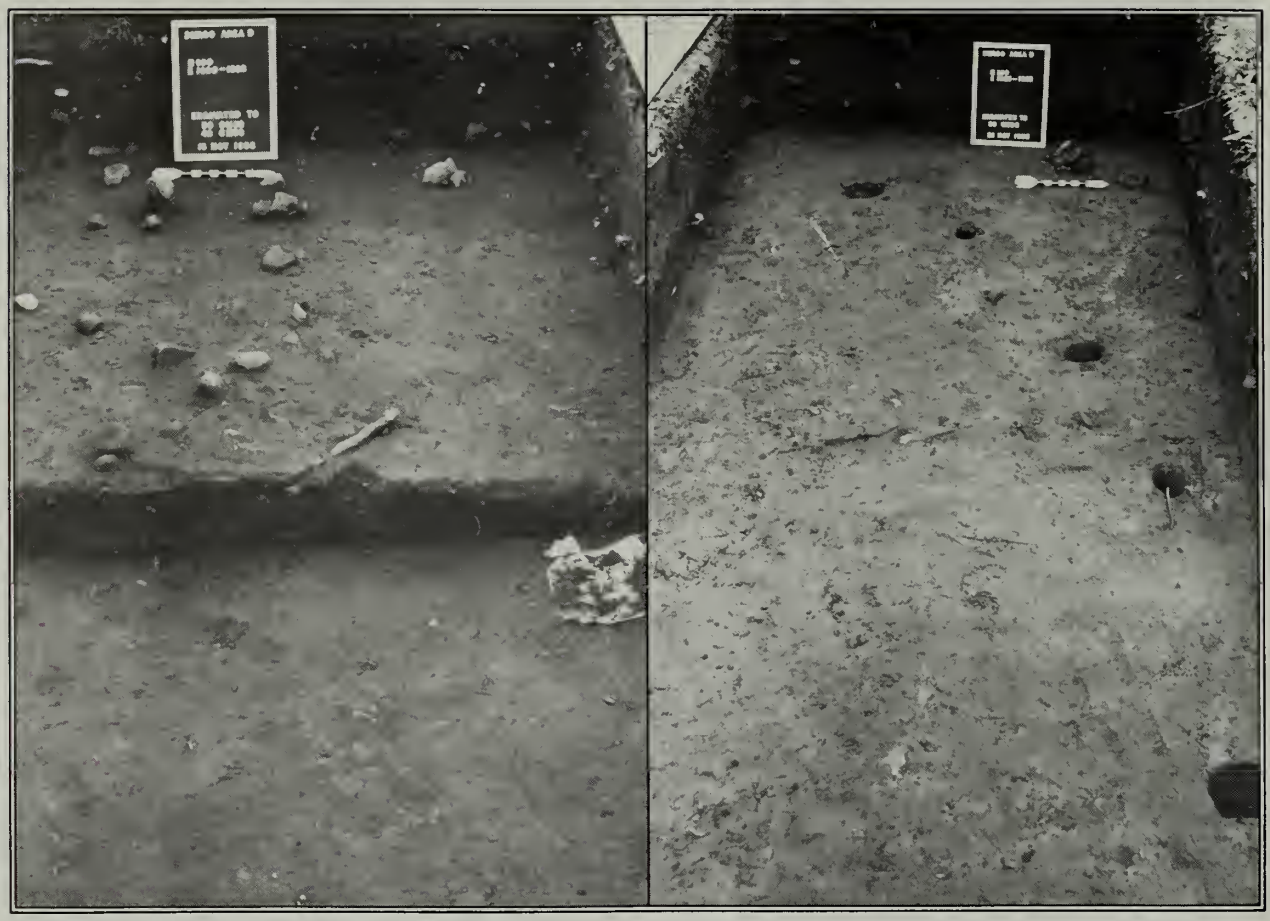


Figure 6-22. West facing view of N990/E1026 excavated to rock strewn living floor at 40 cm below surface (top), and N990/E1028 excavated into Stratum 4 at 50 cm below surface (bottom) (AAS Neg. #886258).

Figure 6-23. West facing view of N990/E1026 and N990/E1028 excavated to 50 cm below surface; arc of excavated postmolds in Stratum 4. (AAS Neg. #886282).

Other Features

During excavation of Backhoe Trench 1 at approximately N994/E1029, a small, basin shaped pit feature roughly 0.5 m in diameter, designated Feature 1, was identified in the midden stratum (Figures 6-27 and 6-28). Backhoe trenching operations were halted and the feature was excavated by hand. The top of the feature was encountered at 28 cm below the ground surface, and the base of the feature extended to 38 cm. Contents of the pit fill included fire cracked rock, animal bone, mussel and snail shells, chipped stone artifacts and flakes, and a single ceramic sherd. This feature is identified as a refuse filled pit, similar to Feature 3.

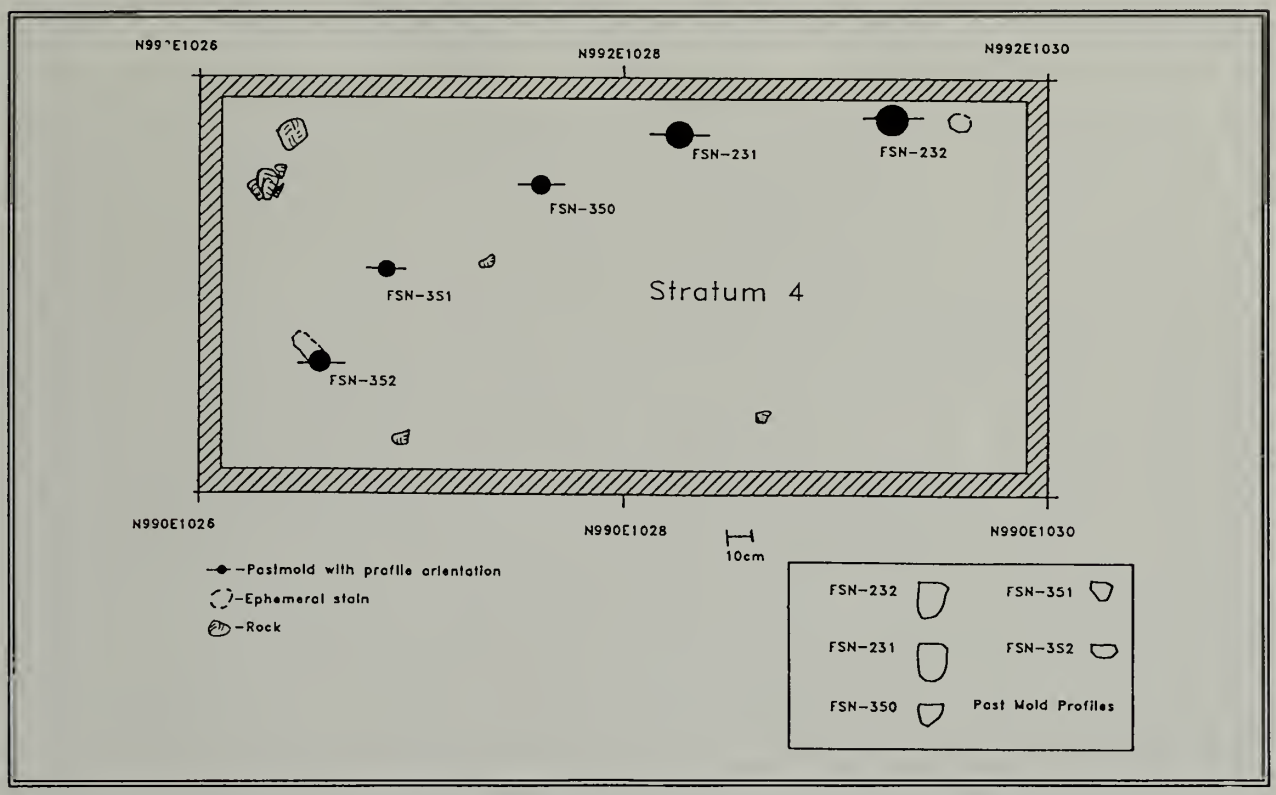


Figure 6-24. 3MR80, Area D, N990/E1026 and N990/1028 at 50 cm below surface. Elevation of N990/E1026 stake = 149.42 m.

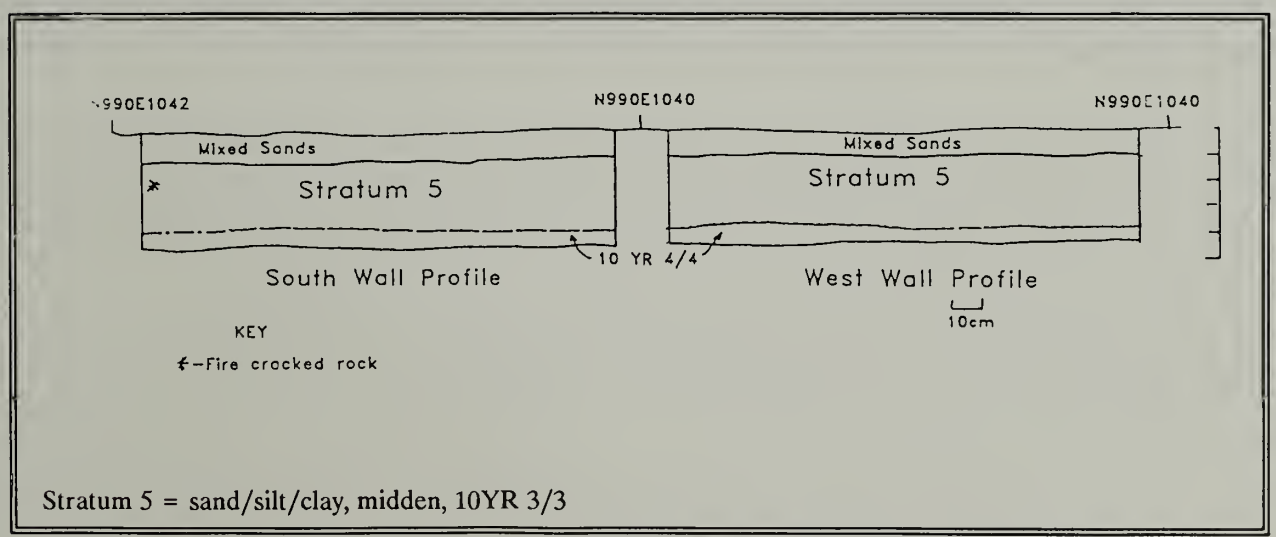


Figure 6-25. 3MR80, Area D, south and west wall profiles of Unit N990/E1040. Elevation of N990/E1040 stake = 149.81 m.

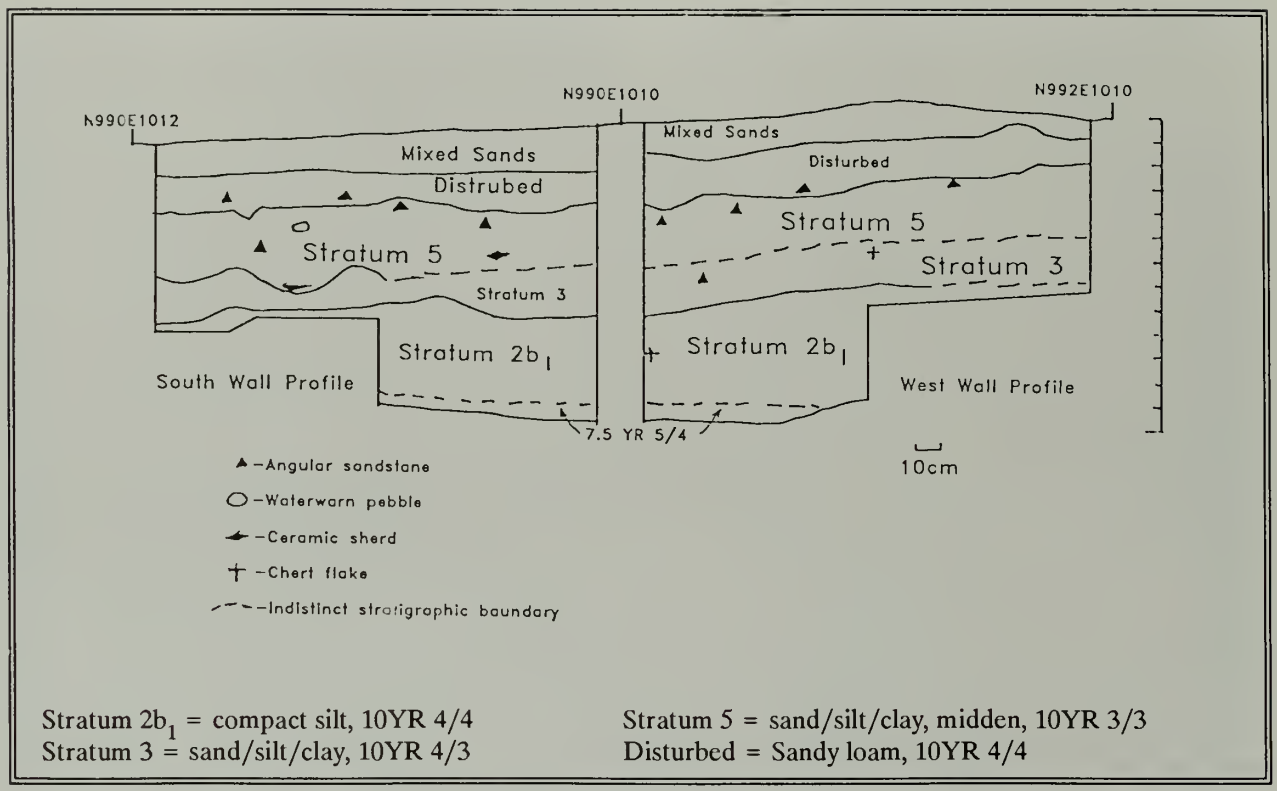


Figure 6-26. 3MR80, Area D, N990/E1026 and N990/1028 at 50 cm below surface. Elevation of N990/E1026 stake = 149.42 m.

The Dalton Area

During excavation of Backhoe Trench 1, four projectile points dating to the Dalton and Early Archaic periods were hand picked out of the Stratum 1b paleosol. One of these points was a Dalton point, one a Rice Lobed point, and two (one of which was a basal fragment) were Graham Cave points. This assemblage suggests that the Stratum 1b paleosol was occupied, perhaps more than once, between 8,000 and 10,500 years ago.

As indicated above, Stratum 1b was reached in units N1005/E1010, N1003/E1020, and N1018/E1036, but no diagnostic artifacts were found in the paleosol in those units. In an effort to retrieve a better sample of early materials from a controlled excavation context, unit N998/E995 was opened. This unit was located close to the part of Backhoe Trench 1 where the artifacts mentioned above were found. By projecting the paleosol from its position in Backhoe Trenches 1 and 2, we also anticipated that it would occur at a depth of approximately 50 cm below the present ground surface in N998/E995.



Figure 6-27. Feature 1 exposed in midden during excavation of Backhoe Trench 1 (AAS Neg. #885859).

Excavations in this unit disclosed a disturbed stratum below the mixed flood sands that extended to a depth of 20 cm (Figure 6-29). Stratum 2b, a sandy clay loam, extended from 20 to 48 cm below the surface. A half-dozen small potsherds found in the upper 10 cm of this stratum were probably introduced from overlying sediments that have since been destroyed. One Early Archaic Big Sandy point base was also collected from the 20 to 30 cm level of this stratum, and the basal fragment of a Dalton point was retrieved from the 30 to 40 cm level. The Stratum 1b paleosol was encountered at a depth of 48 cm below the surface, and in a 10 cm level excavated into this stratum a point fragment exhibiting collateral flaking across the blade was found, along with a small biface fragment.

Chronometry

Careful consideration was given to the submission of samples for radiocarbon dating, their context being the most important consideration for the samples submitted, to insure that a confident determination of exact-

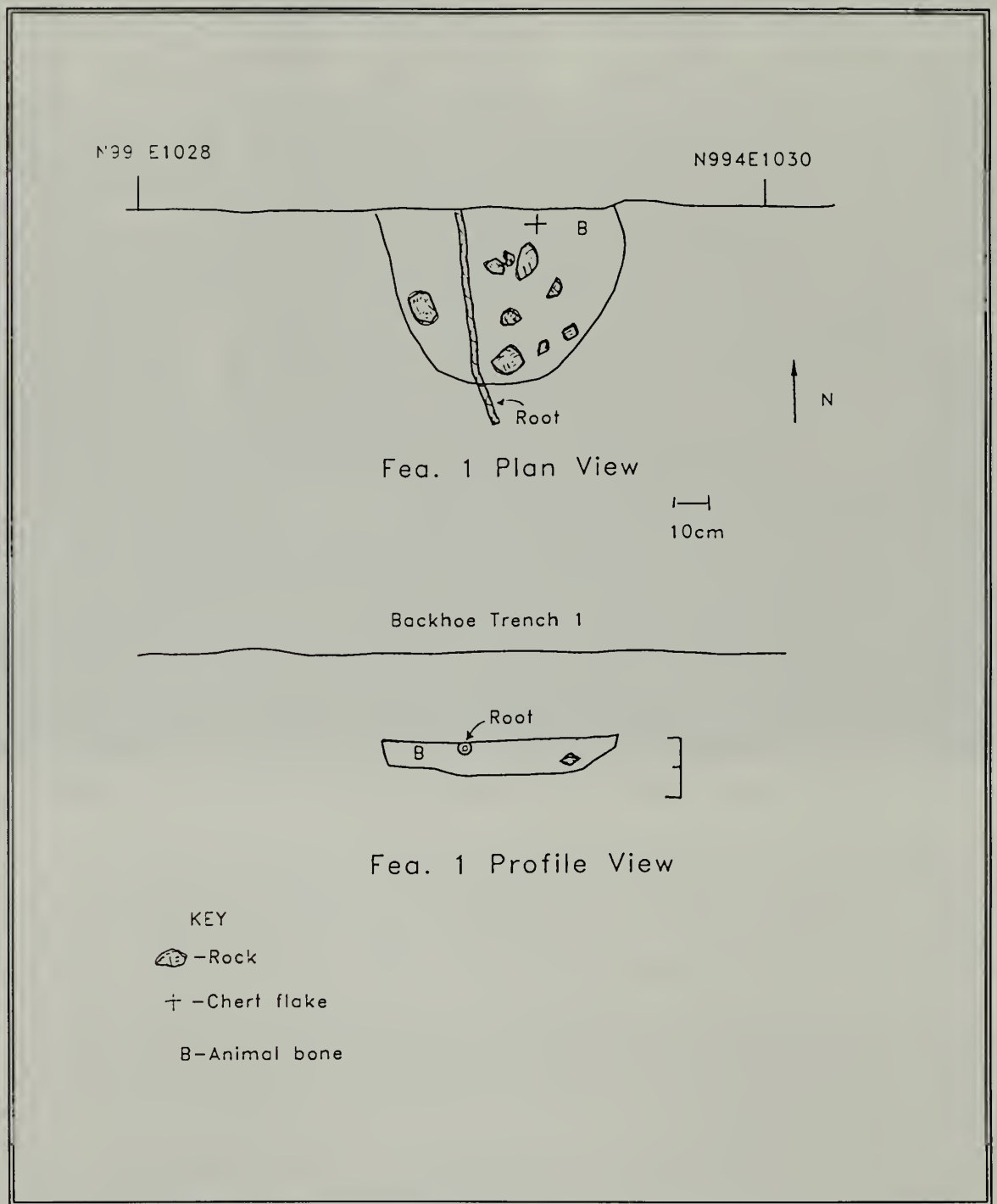
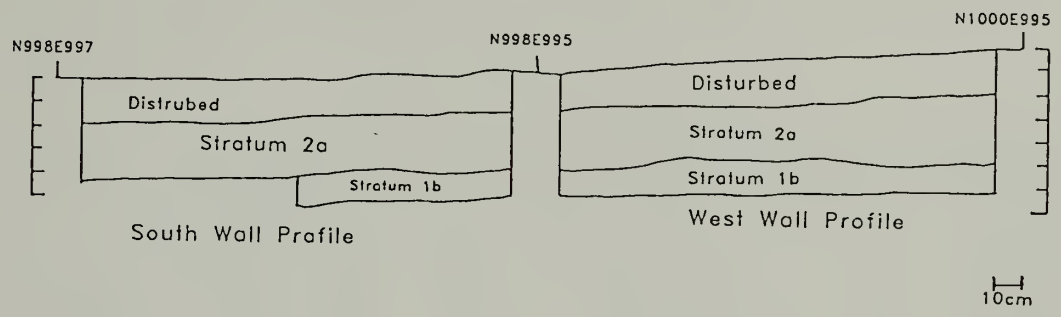


Figure 6-28. 3MR80, Area D, plan and profile of Feature 1. Elevation at top of Feature = 149.37 m.



Stratum 1b = compact sandy clay loam, 10YR 4/6
Stratum 2a = compact silt/clay, 10YR 3/3

Figure 6-29. 3MR80, Area D, south and west wall profiles of Unit N998/995. Elevation of N998/E995 stake = 150.55 m.

ly what was being dated could be made. Ideally, charcoal from the post of a burned house, for example, might be selected because the resulting date could be associated with a specific event at the site. If the dated sample happened to derive from an old post used in the construction of a house, then the resulting radiocarbon assay might be somewhat earlier than the actual burning of the house. However, it would be possible to correct for this error by comparing additional dates measured from charcoal collected from other house posts, or by comparing archeomagnetic dates derived from samples of baked sediments associated with the house burning. By contrast, a date obtained for a piece of charcoal collected from a homogeneous and undifferentiated midden at a habitation site, for example, might be more difficult to interpret. The date would correspond to no particular event in the occupational history of the site, other than the gradual and on-going deposition of trash. On a multicomponent site, the ever present chance that an old piece of charcoal from an earlier occupation might have been incorporated into the midden would be difficult to determine and assays could not be rectified without a large series of assays on samples collected from different levels within the midden.

Unfortunately, the ideal circumstances for chronometric analysis--very tight sample contexts corresponding to specific events in the occupational history of a site, and the availability of multiple samples that can be independently evaluated--were not encountered in our excavations at 3MR80-Area D. On the other hand, careful attention to the contexts of materials that were submitted for radiocarbon measurement produced

results that are directly interpretable and highly significant to considerations both of the occupational history of Area D and to the general cultural history of the Ozark region.

Three samples of carbonized organic material were sent to Beta Analytic, Inc., of Coral Gables, Florida, and the results are summarized on Table 6-1. In reporting these results, the conventional terminology "radiocarbon years before the present (1950 A.D.)" is used. Species identification of botanical materials contained in these samples was made by Dr. Gayle J. Fritz of the University of Michigan Museum of Anthropology, Ann Arbor.

Table 6-1. Results of radiocarbon dating analyses, 3MR80-Area D.

Lab Number	AAS FSN	C-14 Age (RCYBP)	C13/C12	C13 Adj. Age	Calibrated Age[1]
Beta-33079	174	1670 +/- 210 .B.P	-26.3	1650 +/- 210 B.P.	1545 B.P. (A.D. 405)
Beta-33080	420	1450 +/- 80 B.P.	-27.6	1410 +/- 80 B.P.	1308 B.P. (A.D. 642)
Beta-33081	421	890 +/- 60 B.P.	-27.9	840 +/- 60 B.P.	733 B.P. (A.D. 1217)

FSN-174: Small sample (0.17g carbon) of thick hickory nut shell from Feature 4 (extended counting time required.
FSN-420: Small sample (0.60g carbon) of wood charcoal from Feature 4 (extended counting time required.
FSN-421: Wood charcoal from Feature 2.
Radiocarbon half-life = 5568 years.
Error = one standard deviation (68 percent probability).
Radiocarbon dating analyses were performed by Beta Anlytic, Inc.

1 After Stuiver and Pearson (1986).

Two samples were selected from the Feature 4 pit that originated on the rock-strewn living floor at the base of the midden in the 4x4 m block excavation. Both samples were collected from the pit fill. The first sample, FSN-174, was a piece of thick hickory nut shell (therefore representing only a single year of growth) containing 0.17 grams of carbon. The small sample size required extended counting time, and the resulting C13 corrected age is 1650 +/- 210 radiocarbon years before the present (BETA-33079). The second sample, FSN-420, consisted of red oak and some unidentified ring-porous wood charcoal representing no more than 10 annual rings. This sample contained 0.60 grams of charcoal, and with extended counting time yielded a C13 adjusted age of 1410 +/- 80 radiocarbon years before the present (BETA-33080).

The two radiocarbon dates for Feature 4 are concordant. The adjusted ages fall within the Middle Woodland period and, at the 95 percent confidence level, both dates remain within the Woodland era. It is possible that the filling of the Feature 4 pit with refuse could have resulted in the incorporation of carbonized material from earlier occupations, thus yielding a date earlier than the filling event, but the fact that two fairly close Woodland era dates were obtained on two completely different materials--nutshell and wood charcoal--sug-

gests that this is not the most likely explanation. In view of the large number of Rice Side Notched points that occur throughout the midden (three of which were included in the Feature 4 fill), the two dates obtained for this feature are entirely acceptable. By extrapolation, Feature 4 and the living floor at the base of the midden, from which Feature 4 originates, should be of roughly the same age.

The third sample submitted for radiocarbon measurement was a sample of wood charcoal, mostly hickory, white oak, and some unidentified ring-porous species, with a maximum of 12 annual rings, derived from Feature 2 (the possible collapsed structure in N990/E1026). Although there was some hesitation in submitting charcoal from the midden for reasons outlined above, the association of this sample with Feature 2 did provide an interpretable archeological context, though certainly not as tight as the context of the two samples from Feature 4. However, the stratigraphic superposition of this feature above the living floor was considered to be important for the possibility of determining a time span for the occupation represented by the midden stratum. The sample, FSN-421, provided a C13 adjusted age of 840 +/- 60 radiocarbon years before the present. This date represents the Early Mississippi period in the Ozarks (Sabo et al. 1988: 34), and at the 95 percent confidence level remains within the Mississippian era. This result is somewhat surprising since the diagnostic artifact assemblage from the midden--consisting almost entirely of Rice Side Notched, Gary, Langtry, Scallorn, Agee A, and Pocola points and the type of shell tempered pottery associated with that lithic assemblage in the Ozarks (Schambach 1988)--seems more typical of a Middle to Late Woodland cultural affiliation. However, two possible explanations for this date can be suggested. First, a few artifacts collected from the midden, such as a single Reed side notched arrow point, are generally associated with Mississippi period contexts. Thus while Mississippians undoubtedly were at 3MR80-Area D, their occupation does not appear to have left much of an archeological signature. Nonetheless, it is possible that the charcoal sample FSN-421 derived from that occupation. If this is true, then the resulting date would not correspond to most of the materials excavated from the midden.

Another explanation for this date is that the youngest cultural materials in the midden represent an Emergent Mississippian development from the preceding Woodland occupations. Portions of the artifact assemblage, and the ceramics in particular, are similar to Emergent Mississippian sites in southeastern Missouri, including the Gooseneck and Owls Bend sites (Lynott 1989). These and other southeastern Missouri Emergent Mississippian sites have been radiocarbon dated to the 950 - 1,250 B.P. interval, which the FSN-421 date overlaps at the 95 percent confidence level. Of the two explanations for the FSN-421 date, this latter one is preferable in view of the material culture similarity between the Rush midden component and other Emergent Mississippian assemblages. It is important to note, however, that sites representing Emergent Mississippian culture date primarily to the Late Woodland period. For this reason, it seems preferable to ascribe most of the cultural materials from the midden component at Rush to the Middle to Late Woodland period, bearing in mind the important need to refine this chronological assessment.

Cultural Stratigraphy of 3MR80-Area D

The preceding assessment of the stratigraphy and chronology of 3MR80-Area D provides a basis for identifying discrete cultural strata and components. As will be shown below, the distribution of temporally diagnostic artifacts within individual strata supports the general interpretation that each stratum contains cultural materials representing discrete occupational components. In other words, 3MR80-Area D contains stratified, multiple components. This interpretation gains additional support from an examination of the vertical distribution of size graded fire cracked rock. Figure 6-30 illustrates this distribution, showing that, although there is an overall decrease in the amount of fire cracked rock with increasing depth, Strata 2 through 5 contain roughly the same proportion of each size grade. Put more simply, the lower strata contain large, medium, and small size grades in roughly the same proportions as the overlying strata. This observation suggests that the vertical distribution of fire cracked rock in Area D is not simply the result of downward migration of smaller pieces, but rather the result of successive human occupation at separate times as sediments accumulated at the site.

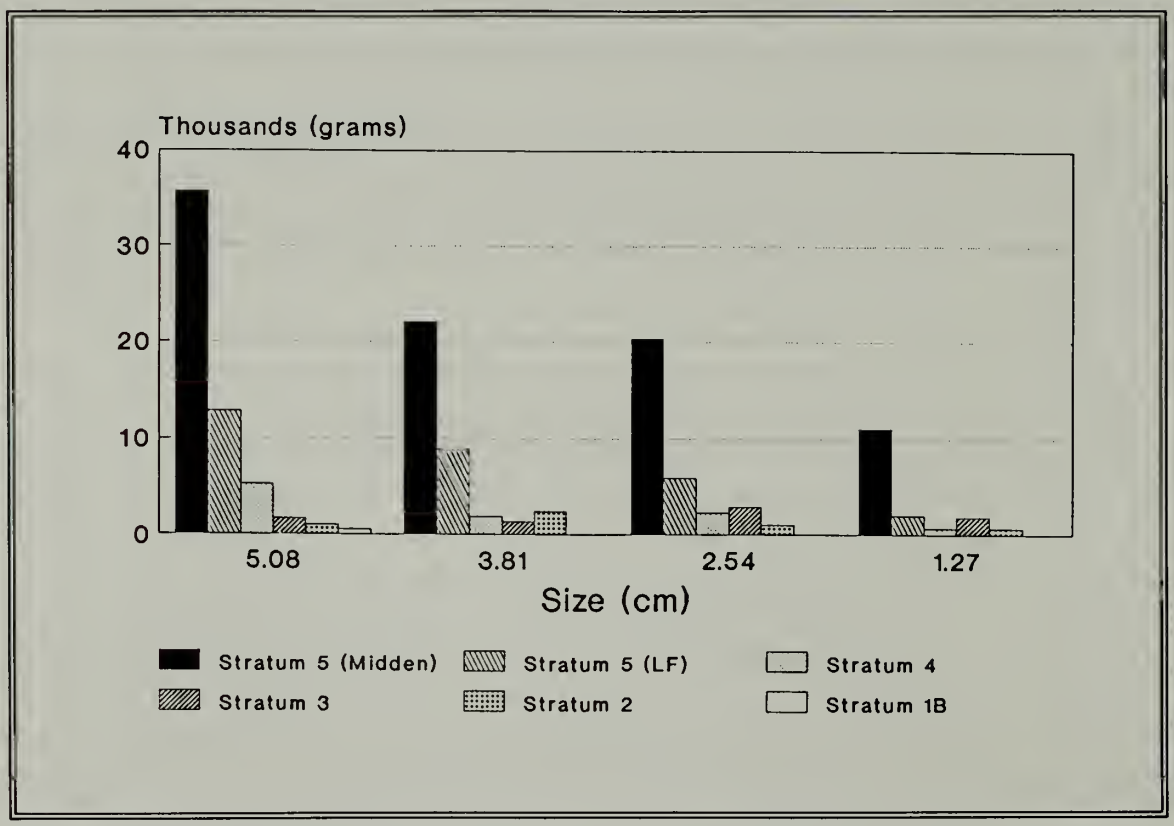


Figure 6-30. Vertical distribution (by stratum) of fire cracked rock by weight (y axis) and size grade (x axis).

Projectile Point Chronology for the Southern Ozarks

Analysis of the stratigraphic distribution of chipped stone projectile points provides a means for determining the approximate age and cultural affiliation of prehistoric components identified at the Dirst site. The basis of this comparative method is the occurrence of specific projectile point types at sites where clearly delineated, radiocarbon dated contexts have been identified. For the southern Ozarks, Kay's (1982c) study of the stratigraphic distribution of projectile points at Rodgers Shelter provides the best documented record of projectile point chronology that has been produced to date. Other useful studies include Marshall's (1958) typology of projectile points from sites in the Table Rock reservoir area and the assessment by O'Brien and Warren (1986) of projectile point chronology at Pigeon Roost Creek in the central Salt River Valley of northeastern Missouri. The following preliminary summary of the projectile point chronology at the Dirst site is based primarily on these three studies. Included in this summary are only those point types represented in the collections resulting from our excavations in Area D of the Dirst site. All radiocarbon dates reported below are given in uncorrected radiocarbon years before present (BP, radiocarbon half-life = 5,568).

Dalton Points

Dalton points were initially identified in Missouri (Chapman 1948), but they have a wide distribution throughout the southeastern United States. They are the diagnostic artifact of the Dalton period or culture, which is generally believed to represent a transitional stage from Paleo-Indian to Archaic cultural manifestations in eastern North America. Dalton points have an overall lanceolate form. Blades range in shape from excurvate to incurvate, depending upon degree of resharpening, and they often are serrated. Lateral margins at the basal end of the point are slightly constricted; this feature along with a deeply concave base produce basal "ears" that flare slightly outward. Thinning flake scars frequently extend from the basal concavity, and the base and lateral margins are usually heavily ground. Extensively reworked Dalton points sometimes take the form of drills, perforators, burins, or endscrapers. At Rodgers Shelter, Dalton points were found in deeply buried strata (Kay 1982c:499-500) from which radiocarbon dates of 10,530 +/- 650 BP (ISGS-48) and 10,200 +/- 330 BP (M-2333) were derived (Kay 1982b:81-106). Dalton points were also found in the earliest cultural deposits at Pigeon Roost Creek, radiocarbon dated at 8,500 +/- 220 BP (TX-3289; O'Brien and Warren 1986:208-223). Goodyear (1982) has suggested an overall date range of 10,500 to 9,900 BP for the Dalton period in the southeast.

Graham Cave Side Notched Points

Graham Cave Side Notched points were first identified at Graham Cave in Missouri where they were found in the lowest cultural deposits at that site (Logan 1952). These points have since been found in deeply buried strata at a number of sites in the midsouth, and they are considered to be diagnostic of the Early Archaic period. They generally exhibit a long, triangular shaped blade that frequently is serrated or has alternate-edge resharpening. Deep side notches perpendicular to the long axis occur just above the base, which has

square sides and a deeply concave basal edge. Basal margins are usually heavily ground. Blade length and serration distinguish this point type from the closely related Big Sandy point. Graham Cave Side Notched points were found in Early and Middle Archaic levels at Rodgers Shelter (Kay 1982c:480-481). These levels were radiocarbon dated between 8,100 +/- 140 (GAK-1170) and 5,100 +/- 400 BP (M-2332; Kay 1982b:81-106). At Pigeon Roost Creek, this point type occurred in the Dalton-Early Archaic levels that produced the previously mentioned radiocarbon date of 8,500 +/- 220 B.P. (TX-3289; O'Brien and Warren 1986:208-223).

Rice Lobed Points

This type was defined on the basis of specimens found in the lowest cultural deposits at the Rice site in the Table Rock reservoir area of southwestern Missouri (Bray 1956; Marshall 1958). It is considered to be an Early Archaic marker. Rice Lobed points have broad, triangular shaped blades that often show evidence of resharpening. The basal element is formed by wide, shallow corner notching resulting in a straight to slightly expending stem. The basal edge is generally concave. The corners of the base are rounded and the basal margins are usually ground. This point type was associated with the Early to Middle Archaic levels at Rodgers Shelter (Kay 1982c:444-445; see above for associated radiocarbon dates).

Big Sandy or White River Archaic Points

An Ozark variant of the Big Sandy point, called the White River Archaic point, was defined by Marshall (1958) from specimens collected during the University of Missouri's Table Rock reservoir investigations. It is generally found in Early to Middle Archaic contexts. This is a medium sized point with a broad, triangular shaped blade, prominent side notches, and a concave basal edge. The sides of the base are generally straight, and basal margins tend to be heavily ground. At Pigeon Roost Creek, several examples of this type were found in Middle Archaic levels from which a series of radiocarbon dates were derived ranging from 6,370 +/- 100 B.P. (TX-3288) to 4,840 +/- 440 B.P. (TX-3323; O'Brien and Warren 1986:209-223).

Williams/Big Creek Points

Williams points were first defined by Suhm, Krieger, and Jelks (1954) on the basis of specimens from several sites in central and eastern Texas. Morse (1970) identified a very similar form in Arkansas that he named the Big Creek point. This point type is generally associated with the Early to Middle Archaic periods, although finds in Late Archaic contexts are not uncommon. Williams points have broad, generally ovate shaped blades and wide, expanding basal stems formed by prominent corner notching. Basal edges are straight to convex. Basal grinding is infrequent. Kay identified several Williams points in Early to Middle Archaic contexts at Rodgers Shelter (Kay 1982c:462-464; see above for associated radiocarbon dates). At Pigeon Roost Creek, Williams points and several closely related forms were found in Late Archaic contexts with associated radiocarbon dates of 2,910 +/- 160 B.P (TX-3143) and 2,900 +/- 250 B.P. (TX-3320; O'Brien and Warren 1986:208-223).

Castroville Points

Castroville points were mentioned by Kelley (1947b) and defined on the basis of specimens from central Texas by Suhm, Krieger and Jelks (1954). This point type also occurs in Oklahoma (cf. Bell and Hall 1953) and western Arkansas, where it is usually found in Middle to Late Archaic contexts. These points have broad, triangular blades that often are asymmetrical in outline. Deep corner notching produces a straight to slightly expanding stem and pronounced barbs at the basal corners of the blade. At Rodgers Shelter, Castroville points were found in Late Archaic levels (Kay 1982c:455) radiocarbon dated at 3,427 +/- 49 B.P. (SMU-524) and 3,359 +/- 68 B.P. (SMU-510; Kay 1982b:99).

Afton Points

Afton points were named by Bell and Hall (1953) after specimens found at Afton Springs, Oklahoma. They are diagnostic of the Late Archaic period. The characteristic blade shape is in two parts with a straight sided to ovate lower or basal portion, drawing sharply to the distal tip from about one half to two thirds up from the proximal blade end. Deep corner notching results in a wide, expanding basal stem and prominent barbs at the basal corners of the blade. These points are usually thin for their size and very well made. Afton points were found in the Late Archaic levels at Rodgers Shelter (Kay 1982c:462; see above for associated radiocarbon dates).

Table Rock Stemmed Points

Table Rock Stemmed points were identified at the Rice site in the Table Rock reservoir area of southwestern Missouri (Bray 1956; Marshall 1958). These points frequently occur in Late Archaic sites in Oklahoma, Arkansas and Missouri. This is a small to medium size dart point with a slightly ovate to parallel sided blade and a narrow, slightly expanding basal stem. Table Rock points were found in Late Archaic and possibly Woodland contexts at Rodgers Shelter (Kay 1982c:431-432; see above for associated radiocarbon dates).

Smith Basal Notched Points

This point type was defined by Baerreis and Freeman (1959) from specimens found at the Smith I and II shelters in northeastern Oklahoma. Temporal affiliation and distribution is essentially the same as the Table Rock point. It is a large, broad bladed point with basal notches forming a straight sided stem and prominent barbs at the basal corners of the blade. Smith points were found in Late Archaic contexts at Rodgers Shelter (Kay 1982c:457-458; see above for associated radiocarbon dates).

Marshall Points

This point type was identified by Kelley (1947a) and defined by Suhm, Krieger and Jelks (1954) from specimens obtained from the Marshall Ford Reservoir in central Texas. The type name has also been applied

to similar specimens from sites in Oklahoma, Arkansas, and Missouri. Marshall points have broad, triangular to ovate shaped blades. Deep corner notching produces an expanding basal stem and prominent barbs at the proximal corners of the blade. The distal tip of the blade is often worked to a very sharp point. Although generally recognized as a Late Archaic point type in the Ozarks, closely related forms from Pigeon Roost Creek occurred in Middle Woodland as well as in Late Archaic contexts. Radiocarbon dates for the Late Archaic levels were given above; three radiocarbon dates for the Middle Woodland levels at Pigeon Roost Creek ranged from 2,100 +/- 100 (TX-3142) to 1,360 +/- 100 (TX-3319; O'Brien and Warren 1986:208-223).

Stone Square Stemmed

The Stone Square Stemmed point was defined by Marshall (1958) from specimens found at the James River site in Stone County, Missouri. The basic point form is widely distributed across the Southern Plains and Eastern Woodlands where it occurs in Late Archaic and Woodland contexts. These are large points with long, straight sided blades and straight, square stems that are slightly narrower than the maximum width of the blade. At Rodgers Shelter, this point type occurred in Late Archaic and Woodland contexts (Kay 1982c:454-455). Associated radiocarbon dates range from 3,427 +/- 49 B.P. (SMU-524) and 2,072 +/- 62 B.P. (SMU-439; Kay 1982b:99-102). At Pigeon Roost Creek, this point type was found primarily in the Late Archaic levels, but a single specimen was also retrieved from the overlying Middle Woodland stratum (O'Brien and Warren 1986:208-223).

Gary *var. Gary* Points

Gary points were initially defined by Newell and Krieger (1949) from specimens found at the George C. Davis site in eastern Texas. This point type is widely distributed across the midsouth, where it is found in Late Archaic and Woodland period contexts. Schambach (1982) recently identified three varieties of Gary points that occur in southwest Arkansas, which he believes represent three temporally successive forms. The earliest of these is the Gary *var. Gary*, which has a triangular shaped blade and a wide contacting stem terminating in a convex to rounded basal edge. Although none of the specimens included in his study has an associated radiocarbon date, Schambach believes that it represents an "ancestral Archaic variety" of the later Gary types (Schambach 1982:174). Specimens that are similar to this variety, however, were found in Woodland contexts at Rodgers Shelter (Kay 1982c:439).

Gary *var. Le Flore* Points

Schambach distinguishes this variety of Gary point on the basis of a more v-shaped contracting stem terminating in a blunt point. He considers this variety to be "an excellent early Fourche Maline marker" (Schambach 1982:176), which, if translated to the Ozark region, would correspond roughly to the Early Woodland period. At Rodgers Shelter, similar point forms were found in Woodland period contexts (Kay 1982c:439).

Langtry Points

First described on the basis of specimens from the Big Bend region of Texas (Kelley et al. 1940), Langtry points have a wide distribution extending across the Southern Plains into Arkansas and Missouri. They are generally associated with Woodland period contexts. This point has a triangular shaped blade and a prominent contracting stem that terminates in a straight basal edge. Langtry points were found in Woodland period contexts at Rodgers Shelter (Kay 1982c:439-441).

Rice Side Notched Points

This point type was identified by Bray (1956) at the Rice site in southwestern Missouri (see also Marshall 1958). It is similar to other point types (Greenbrier, Copena, Steuben, Ansell) found in Middle and Late Woodland contexts throughout the midsouth. The point form is triangular in shape with broad and very shallow side notches. This type was found in Woodland period contexts at Rodgers Shelter (Kay 1982c:500-501). At Pigeon Roost Creek, this type was found in the Middle Woodland and Late Woodland/Early Mississippian levels. Radiocarbon dates for the later levels ranged from 2,390 +/- 640 B.P. (TX-2984) to 550 +/- 100 B.P. (TX-3140; O'Brien and Warren 1986:208-223).

Scallorn Arrow Points

This arrow point type was identified by Kelley (1947b) and defined by Suhm, Krieger and Jelks (1954) from specimens found in central Texas. It has since been recognized on numerous Late Woodland and Mississippian sites across the midsouth. Scallorn points have a small, triangular shaped blade that is often serrated. Corner notching produces an expanding stem that has a straight to convex basal edge. This form occurs in Late Woodland contexts at Rodgers Shelter (Kay 1982c:425-429), and in Late Woodland/Early Mississippian contexts at Pigeon Roost Creek (O'Brien and Warren 1986:208-223; see above for associated radiocarbon dates).

Agee A Arrow Points

This point type was identified by Brown (1976) as a variant of the Agee point initially defined by Wood (1963). These are corner notched points with deep haft openings and barbed shoulders. Agee A blades are serrated and are larger than those typically found on Agee points. This point form is associated with the Spiro I period (or Evans Phase), which predates A.D. 1000 (Brown, personal communication 1990).

Pocola Arrow Points

Brown (1976) defines this as corner notched type with wide haft openings, concave bases, and coarsely serrated blades that exhibit incurvate lateral edges. Pocola points are associated with the Spiro I period (or Evans Phase; Brown, personal communication 1990).

Reed Side Notched Arrow Points

This arrow point type was first recognized at the Reed site in eastern Oklahoma (Bell 1958). It occurs on Mississippi period sites in Oklahoma, Arkansas, and Missouri. The Reed point is a small triangular arrow point with side notches and a straight to concave basal edge. This type was found in the Late Woodland/Early Mississippian levels at the Pigeon Roost site (see above for associated radiocarbon dates).

Stratum 1b - The Dalton to Early Archaic Component

The occurrence of one Dalton, two Early Archaic Graham Cave, and one Early Archaic Rice Lobed projectile points in the Stratum 1b paleosol suggests one or more very early cultural components, probably dating between 8,000 and 10,500 years ago. Furthermore, the occurrence in this stratum of cores, flakes, and a limited assemblage of other stone tool categories indicates that additional excavations could provide material representing this component reflecting both the manufacture and utilization of stone artifacts. The identification of archeobotanical remains preserved in flotation samples collected from the paleosol--even in very small quantities--is highly significant, since it might be possible, with further excavations and flotation processing of sediments, to recover additional specimens reflecting Dalton to Early Archaic subsistence activities. Given the almost total lack of subsistence data for these time periods in the Ozarks, any evidence of this nature would be of extraordinary importance. Finally, although it is unlikely that Stratum 1a contains charcoal in sufficient amounts for radiocarbon dating, the humates in bulk samples of the paleosol could be radiocarbon dated.

The paleosol occurs conformably above the late Pleistocene age lag gravels. Figure 6-1 illustrates the projected area where this paleosol should occur within 1.5 m of the present ground surface. It is within this area that the Dalton and Early Archaic projectile points were found. Since the paleosol was also identified in N1003/E1020, it is possible that early cultural materials exist in deeply buried contexts beneath the lower midden area of the site.

Stratum 2 - A Possible Early to Middle Archaic Horizon

No temporally diagnostic artifacts were retrieved from controlled excavations into Stratum 2 sediments. However, a number of stemmed and notched Early to Late Archaic projectile point types were collected during the backhoe trenching, many of which came from Stratum 2. Point types that occur in Stratum 2 include Dalton (1), Big Sandy (2), Marshall (1), Stone (1), and Table Rock (1). Other Early to Middle Archaic artifacts found in overlying strata may also have been originally deposited in the more deeply buried sediments of this stratum. On the basis of these observations, it is possible to postulate one or more Early to Middle Archaic components associated with Stratum 2. Any such components would likely fall into the 8,000 to 5,000 BP time period. Further excavations to more extensively sample the artifact content of this stratum would be necessary to test this hypothesis.

Stratum 3 - The Late Archaic Component

Projectile points representing the Afton (1), Castroville (1), and Stone Square Stemmed (1) types were found in Stratum 3. Along with other associated cultural materials, these artifacts suggests a Late Archaic component, possibly dating between 5,000 and 2,500 BP. A substantial number of artifacts representing this component were collected from a 5 cm level excavated at the surface of Stratum 3, where an intact occupation surface seemed to exist. The lack of any features associated with this surface, such as pits, hearths, or post-mold patterns, suggests that the Late Archaic habitation of Area D may have been transitory, but it must also be remembered that the excavations sampled only a very limited area of this stratum. Cultural materials associated with this surface include several morphofunctional stone tool categories, as well as stone tool manufacturing debris including cores, flakes, and preform fragments. Thus, on the basis of presently available data, it is possible to partly reconstruct the processes involved in stone tool manufacture and to make conjectures concerning some of the prehistoric activities that produced this component.

As will be seen in Chapters 7 and 8, some faunal and floral remains are preserved in Stratum 3, thereby providing a basis for tentative interpretations concerning Late Archaic subsistence at the Dirst site. Unfortunately, the floral and faunal samples from this stratum are neither particularly abundant nor are they very well preserved. It is possible that the Late Archaic occupation surface remained exposed for some time following abandonment of the site, which resulted in the partial decomposition of organic materials before they were buried under subsequent overbank deposits.

This project's excavations did not produce carbonized samples of sufficient size for radiocarbon dating this component, but there is no reason to doubt that additional excavations could succeed in retrieving an adequate sample for this purpose.

Stratum 4 - The Early Woodland Component

Stratum 4 was encountered directly beneath the rock-strewn living floor at the base of the midden in Area D, and it contained artifacts suggesting an earlier occupation than that associated with the midden. Projectile points included examples of the Afton (1) and Langtry (1) types, in addition to a Stone Square Stemmed point that exhibits an unusual alternate beveled, serrated edged blade. A Big Sandy point found in this stratum is presumed to have been redeposited from a lower level. A large advanced preform was also found in Stratum 4 that exhibits the characteristic blade shape of an Afton point. Two thick, grog tempered potsherds were retrieved from a level well within Stratum 4. In this context, these sherds probably occur as a result of primary deposition. By contrast, two shell tempered sherds found in the top of Stratum 4 just beneath the rock strewn living floor were possibly displaced from that overlying stratum. In evaluating these observations, it seems likely that Stratum 4 represents an Early Woodland component, which should date somewhere in the interval between 2,500 to 1,800 B.P. This tentative conclusion requires the support of additional evidence before great confidence can be attributed to it; however, if this conclusion is true, then it would be one of great significance,

since heretofore it has not been possible to stratigraphically isolate an Early Woodland component at an open habitation site anywhere in the Arkansas Ozarks. Moreover, the production of pottery has previously been considered as commencing in the Ozark region during Middle Woodland times (e.g., Brown 1984a; Sabo et al. 1988), some 700 years later than the beginning of the Early Woodland period.

Although the artifact content of Stratum 4 is considerably less than that of the Stratum 5 midden component, a large number of artifacts were collected from Stratum 4, and these represent a variety of morphofunctional categories. Thus, some consideration will be given in the following chapter to the technology of stone tool manufacture associated with this component, and some of the activity sets associated with this assemblage will be identified. The arc of postmolds discovered in Stratum 4 furnishes additional insights concerning the nature of the occupation this component represents. But until additional excavations are undertaken to more fully investigate this feature, its interpretive potential will be limited.

Faunal and floral remains preserved in Stratum 4 permit provisional reconstruction of at least some Early Woodland subsistence activities at the Dirst site. Again, in view of the current lack of subsistence data for the Late Archaic to Early Woodland period in the Ozarks, any insights derived by studying materials associated with this component will be important. Preservation of faunal and floral remains in Stratum 4 was relatively poor. This indicates that, like Stratum 3, the occupation surface associated with this stratum may have been exposed for some time following its abandonment, resulting in the accelerated deterioration of organic remains.

Radiocarbon dating was not attempted for the small sample of carbonized materials we collected from Stratum 4. Although it might be possible to derive a radiocarbon date by employing the accelerator mass spectrometry technique to measure radioactivity in the carbon samples we obtained from the fill of the postmolds in N990/E1026 and N990/E1028, this process is very expensive. Again, it seemed more prudent to reserve this option in the hope that additional excavations can be undertaken to completely expose the postmold feature in Stratum 4, and perhaps to collect more suitable samples for radiocarbon or archeomagnetic dating.

Stratum 5 - The Middle to Late Woodland Midden Component

By far the most abundant evidence of prehistoric occupation at 3MR80-Area D was derived from Stratum 5, which contained the midden and underlying living floor. As discussed above, radiocarbon dating of samples from specific features within this midden suggests occupation from Middle Woodland to Early Mississippian times, with most of the cultural materials ascribed to the Middle to Late Woodland periods. The Middle Woodland interval for the Ozark region is between 1,800 - 1,350 BP, and the Late Woodland period continues from 1,350 to the Mississippi period transition, which occurred at about 1,100 BP.

A great quantity of cultural materials was collected from this component. Identifiable projectile points represent a characteristic assemblage, and the primary diagnostics of this assemblage are Rice Side Notched

dart points and Scallorn arrow points (Figures 6-31 through 6-33). Other projectile points that occur in significantly lesser quantities include Gary *var. Le Flore* and Langtry dart points and Agee A and Pocola arrowpoints. Several Archaic point types were found here, but in all likelihood were displaced from more deeply buried strata. Ceramics found in the midden component are predominately shell tempered. Sherds tempered with grog, grog and bone, and shell and bone were also found in limited numbers. Only a few sherds were decorated, but an incised rim sherd of the Coles Creek type, a red filmed rim sherd, and a few cord marked sherds fit within the radiocarbon dated time frame of this component. All of the decorated sherds were grog tempered except for the red filmed sherd, which was shell tempered. The characteristics of this ceramic assemblage make it possible to undertake some regional comparisons of Middle to Late Woodland pottery making traditions, which are considered in Chapter 13.

A wide range of morphofunctional tool types represented in the inventory of stone tools from Stratum 5 permits a more detailed assessment of prehistoric activities for this component than is possible for the earlier components at the site. The huge amount of chipping debris, cores, preforms, and other broken pieces makes it possible in Chapter 9 to reconstruct detailed models of the Middle to Late Woodland technology employed for making stone tools, and some related issues are also explored in that chapter and in Chapter 12 concerning the acquisition of raw materials for stone tool production.

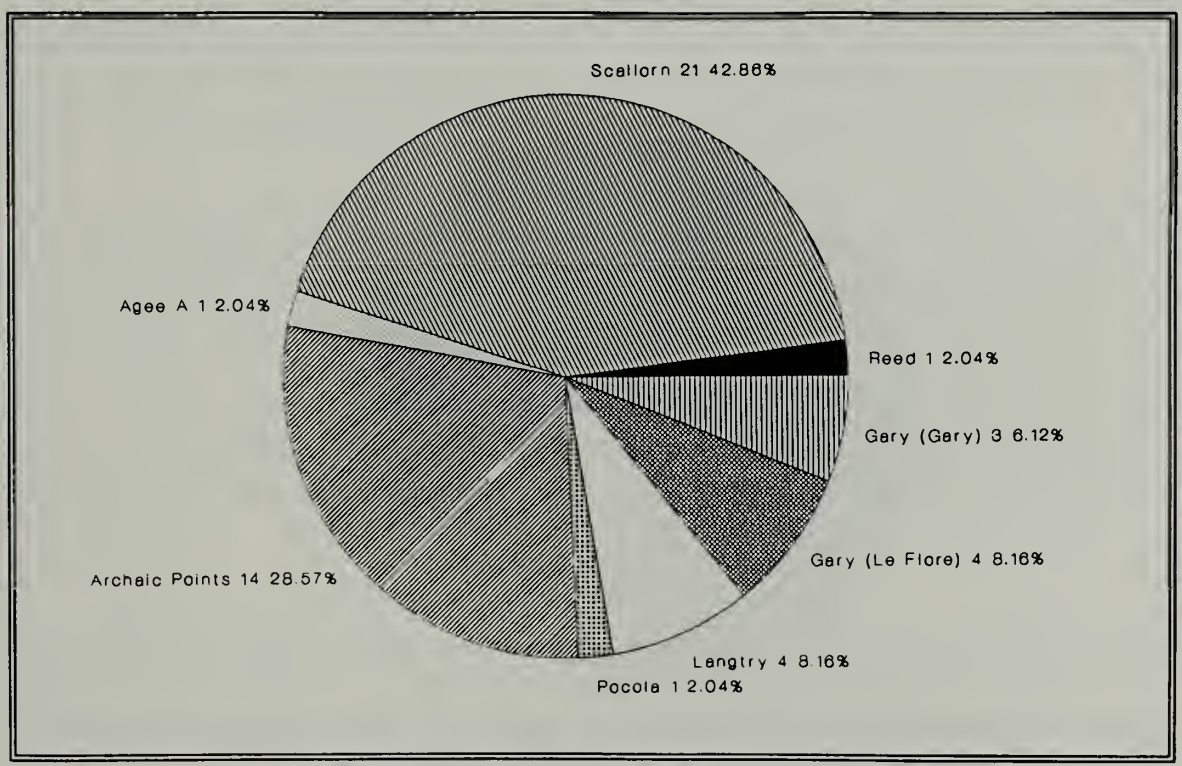


Figure 6-31. Identifiable projectile points from Stratum 5 (midden).

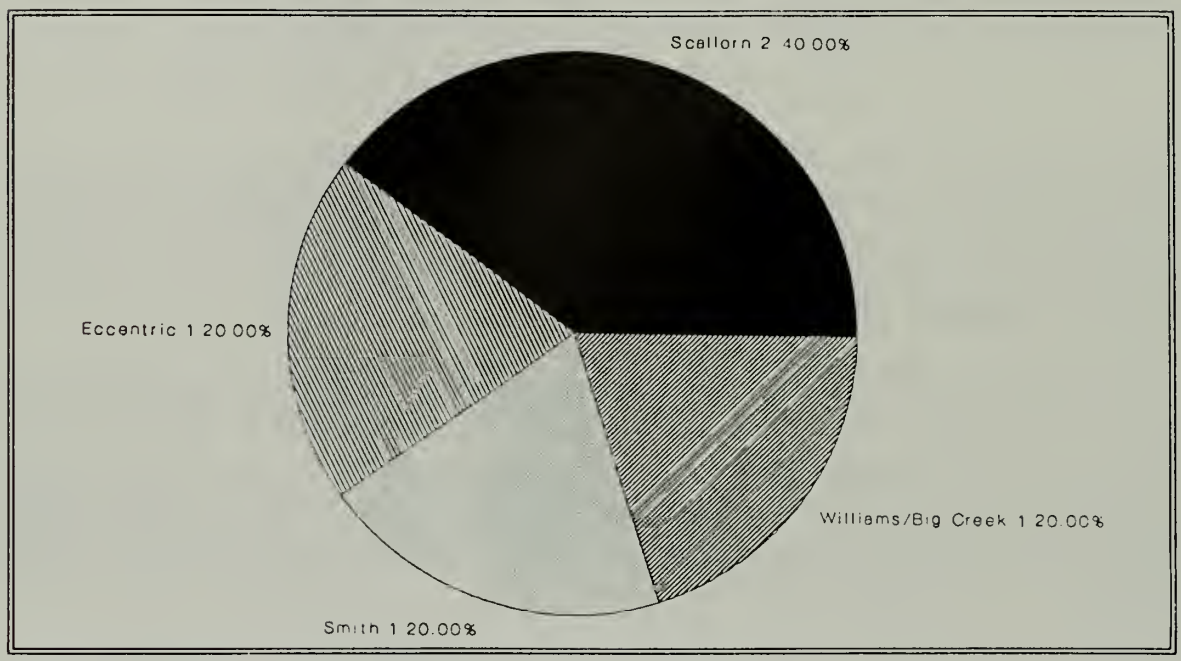


Figure 6-32. Identifiable projectile points from Stratum 5 (living floor).

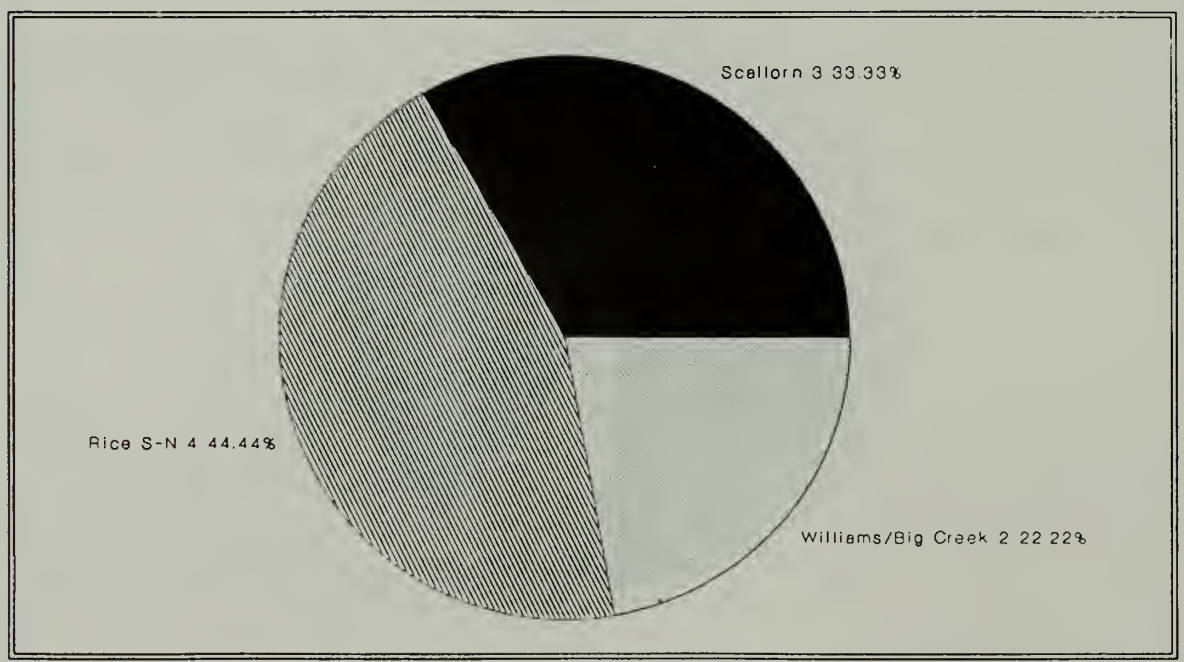


Figure 6-33. Identifiable projectile points from Stratum 5 (Feature 4).

Further evidence bearing upon the nature of the Middle to Late Woodland habitation at 3MR80-Area D is derived from the features associated with this component. These include the rock strewn living floor, the Feature 4 pit, the Feature 2 concentration within the midden, and the two refuse filled pits (Features 1 and 3) that were also identified in the vicinity of Feature 2.

As discussed by Susan Scott in Chapter 8, the faunal remains from Stratum 5 were in an excellent condition of preservation, and the sample derived from the excavations seems to be completely representative of the aboriginal deposition of faunal elements into the midden stratum. Unfortunately, preservation of floral remains is somewhat more problematic. On the basis of her assessment of the carbonized floral remains, Gayle Fritz suggests that either these remains are not well preserved in the midden component or that the flotation processing methods employed during the excavations were not effective in retrieving carbonized specimens. There are a number of reasons why the latter explanation may be the case. First, the sediments collected from the midden for flotation processing contained a large fraction of clay particles. No attempt was made to disperse these clays with trisodium phosphate or other detergent, since Survey personnel wished to avoid introducing such pollutants into the Buffalo River. Clay particles adhering to carbonized plant remains could have prevented their capture in the light fraction flowing out of the flotation barrel spout. Alternatively, the movement of ground water through the Stratum 5 sediments over several hundreds of years could have deposited silicates in carbonized plant remains (Bob Harris, personal communication). This also would prevent their retrieval in the flotation sample light fraction. In any event, the heavy fractions derived from the flotation processing contain what seems to be an unusually large amount of carbonized material. This material has not been separated from the heavy fractions, and thus there may be unidentified floral specimens in the excavations collections curated at the Arkansas Archeological Survey laboratory in Fayetteville.

Several very small fragments of burned and unburned human bone were found in the Stratum 5 midden. No significant associations with other materials or features could be discerned in the distribution of these materials. The size of the fragments and their archeological context suggests a secondary deposition. Following the policy of the Arkansas Archeological Survey, these remains were examined by Ms. Barbara A. Burnett of the Bioarcheology Laboratory, Department of Anthropology, University of Arkansas, Fayetteville. Her analysis identified the remains of at least three individuals: a possible cremation of an individual of undetermined age but possibly adult; a very young child possibly under two years of age at death; and an adult which exhibits moderate to heavy osteoarthritis. The complete description of these remains by Ms. Burnett is provided in Appendix 3.

Area D Boundary Testing

As mentioned in Chapter 3, shovel tests and 50x50 cm column samples were excavated to the west and to the north of the primary impact zone of Area D in an effort to determine the actual boundaries of this portion of 3MR80. Figures 6-34a and 6-34b illustrates the north wall profiles of the column samples. Excavation of the column samples was terminated upon completion of the sixth one, located 60 meters from the primary

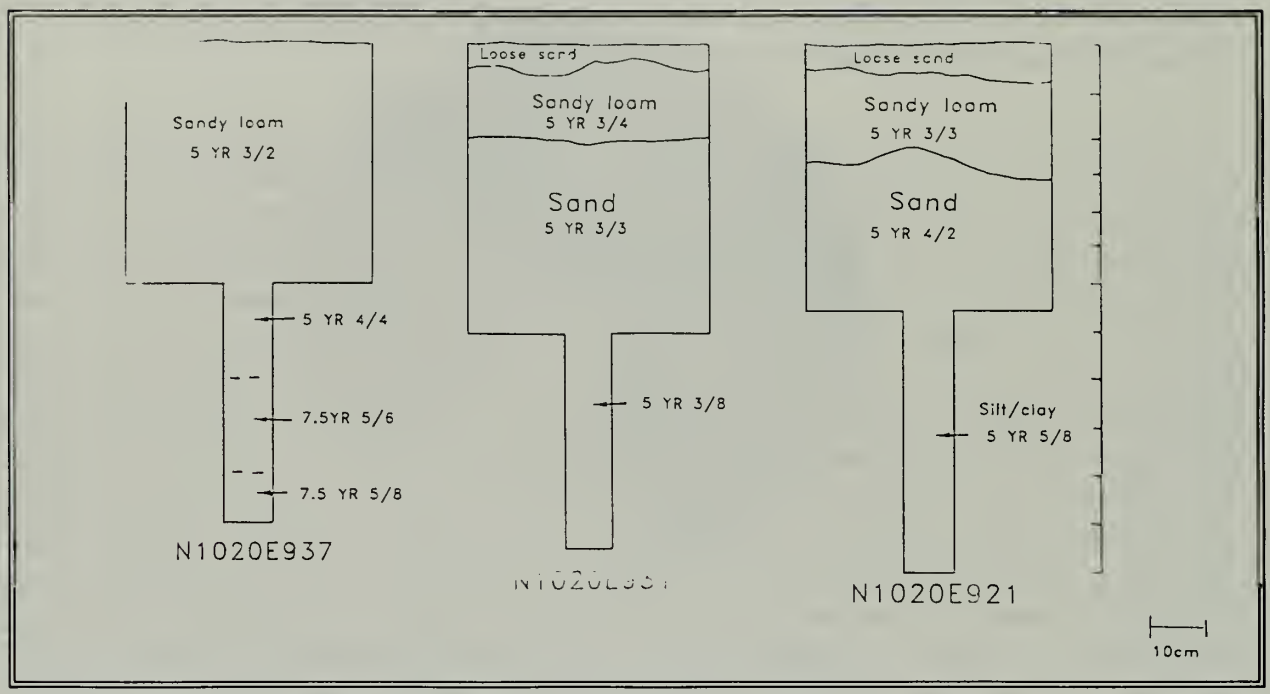


Figure 6-34a. 3MR80-Area D, north wall profiles of 50x50 cm Test Units.

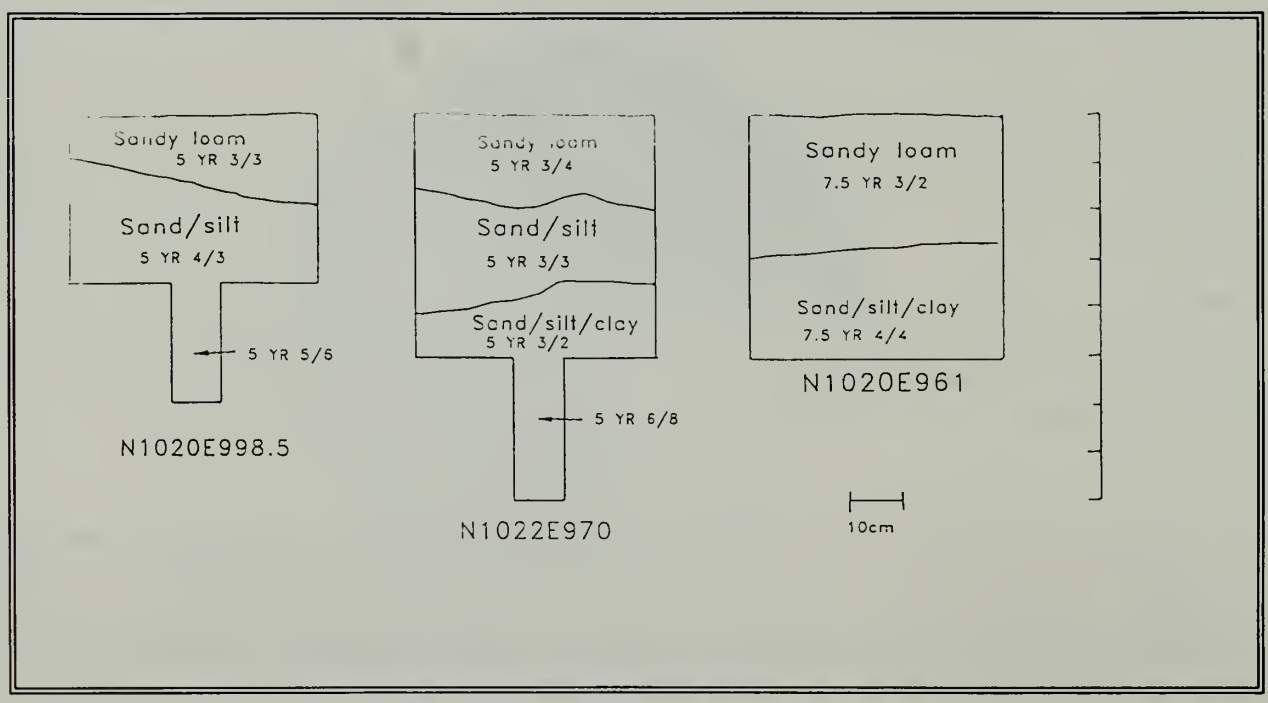


Figure 6-34b. 3MR80-Area D, north wall profiles of 50x50 cm Test Units.

impact zone of Area D, when it became apparent that the amount of cultural materials collected in these test units was not declining. At this point, excavation of a series of shovel tests on the west side of the campground access road was commenced on a northwest oriented transect along the "spine" of high ground bisecting Area D. Ten shovel tests were excavated at 10 m intervals, to a point where the gradually inclining topography reached the foot of a steeper hillslope. Since all of these shovel tests produced artifacts, it was decided to extend the western boundary of Area D to this landform transition. Later, during the course of excavations, an additional series of shovel tests was excavated on a 10 m grid to the north of the Area D primary impact zone. Once again, each shovel test produced artifacts. This latter shovel tested area is bounded by Rush Creek where it swings to the northwest and is crossed by the low water bridge along the campground access road. The northern boundary of Area D was thus extended to the creek.

Further test excavations in these extended portions of Area D will be necessary to define the nature of the cultural deposits they contain. The amended site boundaries have been added to the state site file records in the Registrar's office at the Arkansas Archeological Survey.

CHAPTER 7

Archeobotanical Remains from the Dirst Site, Buffalo National River, Arkansas

GAYLE J. FRITZ

Introduction

The light fractions of 57 flotation samples from Area D of the Dirst site (3MR80) near the Buffalo River in the central Ozark Highlands have been analyzed and tabulated. These materials were recovered as a result of the flotation of 1842.9 liters of soil from features and midden matrix. Types of carbonized plant remains present in the light fractions include wood charcoal, cane stem, other (unidentified) stem, thick hickory nutshell, Juglandaceae nutshell (the family that includes both hickories and walnut), unidentified nutshell, acorn shell, acorn nutmeat, Cucurbita pepo (squash/gourd) rind, maize cupules and glumes, maize kernel fragments, seeds, and unknown materials. In addition, the light fractions contain fungal fragments, pieces of bone, snail shells, mollusc shell fragments, chert flakes, small stones, rootlets and other uncarbonized modern vegetal matter, clods of hardened soil, and one small ceramic sherd. Complete results are presented in Tables 7-1a, 1b, and 1c.

In addition to flotation recovered archaeobotanical remains, 56 samples contain larger fragments recovered during troweling or routine screening (1/4") operations. These are tabulated in Table 7-2a and 2b. The hand picked and screened samples added the taxon of walnut shell, which was not identified in light fraction samples. A relatively high number of thick hickory nutshell fragments was present in the hand picked/screened group of samples, as well, leading to inferences concerning effectiveness of flotation recovery, discussed below.

Archeobotanical remains from the Dirst site present the opportunity of reconstructing pre-Mississippian plant use in the central Ozark Highlands. Basic issues include the degree to which upland groups participated in native starchy seed husbandry and the extent to which processes and pressures leading to maize adoption were like those operating in contemporary groups in the major river valleys of eastern North America.

Laboratory Methods

Samples were weighed and the contents then passed through a series of graduated geological sieves to facilitate sorting. Analysis was conducted in the Ethnobotanical Laboratory at the University of Michigan

Table 7-1a. Contents of light franctions from the Dirst site (3MR80).

UNIT	FSN #	STR-TUM	FEA. #	VOL. (1)	WOOD WT (g)	CANE #	CANE WT. (g)	STEM #	STEM WT. (g)	HKRY NUT #	HKRY WT. (g)	JUGL NUT #	JUGL WT. (g)
** N990 E1010													
N990 E1010	252	5	0	25.0	0.01	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1010	340	5	0	8.0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1010	366	5	0	12.5	0.02	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1010	375	3	0	25.0	0.01	0	0.00	0	0.00	1	0.01	0	0.00
N990 E1010	385	3	0	25.0	0.01	0	0.00	0	0.00	0	0.00	0	0.00
** Subtotal **													
				95.5	0.05	0	0.00	0	0.00	1	0.01	0	0.00
** N990 E1018													
N990 E1018	213	5	0	25.0	0.03	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1018	264	5	0	25.0	0.09	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1018	337	LF	0	8.0	0.01	0	0.00	0	0.00	0	0.00	0	0.00
** Subtotal **													
				58.0	0.13	0	0.00	0	0.00	0	0.00	0	0.00
** N990 E1020													
N990 E1020	236	5	0	12.5	0.03	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1020	349	LF	0	8.0	0.16	0	0.00	0	0.00	1	0.02	0	0.00
N990 E1020	394	4	0	27.5	0.01	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1020	408	4	0	25.0	0.03	0	0.00	0	0.00	0	0.00	2	0.01
N990 E1020	411	4	0	25.0	0.03	0	0.00	0	0.00	0	0.00	0	0.00
** Subtotal **													
				98.0	0.26	0	0.00	0	0.00	1	0.02	2	0.01
** N990 E1026													
N990 E1026	275	5	0	27.5	0.01	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1026	298	5	0	25.0	0.26	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1026	316	LF	0	12.5	0.04	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1026	327	4	0	12.5	0.04	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1026	288	5	2	128.0	1.78	14	0.38	0	0.00	2	0.04	0	0.00
** Subtotal **													
				205.5	2.13	14	0.38	0	0.00	2	0.04	0	0.00
** N990 E1028													
N990 E1028	131	5	0	25.0	0.08	0	0.00	0	0.00	0	0.00	1	0.01
N990 E1028	167	5	0	25.0	0.04	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1028	194	4	0	25.0	0.01	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1028	162	5	2	42.0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1028	164	5	3	10.0	0.02	0	0.00	0	0.00	0	0.00	0	0.00
** Subtotal **													
				127.0	0.15	0	0.00	0	0.00	0	0.00	1	0.01
** N990 E1040													
N990 E1040	294	5	0	25.0	0.04	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1040	311	5	0	25.0	0.03	0	0.00	0	0.00	0	0.00	0	0.00
** Subtotal **													
				50.0	0.07	0	0.00	0	0.00	0	0.00	0	0.00

Table 7-1a. Continued.

UNIT	FSN #	STR-TUM	FEA. #	VOL. (l)	WOOD WT (g)	CANE #	CANE WT. (g)	STEM #	STEM WT. (g)	HKRY NUT #	HKRY WT. (g)	JUGL NUT #	JUGL WT. (g)
** N998 E995													
N998 E995	363	2a	0	25.0	0.02	0	0.00	0	0.00	0	0.00	0	0.00
N998 E995	372	2a	0	25.0	0.01	0	0.00	0	0.00	0	0.00	2	0.02
N998 E995	388	1b	0	25.0	0.01	0	0.00	0	0.00	0	0.00	0	0.00
** Subtotal **													
				75.0	0.04	0	0.00	0	0.00	0	0.00	2	0.02
** N1003E1020													
N1003E1020	192	5	0	25.0	0.01	0	0.00	0	0.00	1	0.01	0	0.00
N1003E1020	196	5	0	25.0	0.01	0	0.00	0	0.00	0	0.00	0	0.00
N1003E1020	258	LF	0	12.5	0.01	0	0.00	0	0.00	1	0.01	0	0.00
N1003E1020	332	4	0	25.0	0.01	0	0.00	0	0.00	0	0.00	0	0.00
N1003E1020	355	3	0	12.5	0.01	0	0.00	0	0.00	0	0.00	0	0.00
N1003E1020	359	3	0	25.0	0.01	0	0.00	0	0.00	1	0.01	0	0.00
N1003E1020	369	3	0	25.0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
N1003E1020	378	2	0	25.0	0.01	0	0.00	0	0.00	0	0.00	0	0.00
N1003E1020	381	2-1B	0	25.0	0.01	0	0.00	0	0.00	0	0.00	0	0.00
N1003E1020	391	1b	0	25.0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
** Subtotal **													
				225.0	0.08	0	0.00	0	0.00	3	0.03	0	0.00
** N1003E1022													
N1003E1022	223	5	0	25.0	0.01	0	0.00	0	0.00	0	0.00	0	0.00
N1003E1022	225	5	0	25.0	0.01	0	0.00	0	0.00	0	0.00	0	0.00
** Subtotal **													
				50.0	0.02	0	0.00	0	0.00	0	0.00	0	0.00
** N1005E1020													
N1005E1020	135	5	0	25.0	0.01	0	0.00	0	0.00	0	0.00	1	0.01
N1005E1020	157	5	0	25.0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
N1005E1020	170	LF	0	25.0	0.01	0	0.00	0	0.00	0	0.00	0	0.00
N1005E1020	175	LF	4	126.0	1.63	10	0.06	1	0.01	9	0.08	0	0.00
N1005E1020	184	5	6	9.0	0.01	0	0.00	0	0.00	0	0.00	0	0.00
** Subtotal **													
				210.0	1.66	10	0.06	1	0.01	9	0.08	1	0.01
** N1005E1022													
N1005E1022	187	5	0	25.0	0.01	0	0.00	0	0.00	0	0.00	0	0.00
N1005E1022	204	5	0	25.0	0.01	0	0.00	0	0.00	0	0.00	0	0.00
N1005E1022	291	LF	0	12.5	0.01	1	0.01	0	0.00	1	0.01	0	0.00
N1005E1022	238	LF	4	234.0	9.98	3	0.02	0	0.00	44	0.43	8	0.04
N1005E1022	241	LF	4	135.0	6.58	7	0.04	0	0.00	23	0.21	0	0.00
N1005E1022	245	LF	4	162.0	3.06	2	0.02	0	0.00	20	0.12	0	0.00
** Subtotal **													
				593.5	19.6	13	0.09	0	0.00	88	0.77	8	0.04
** N994 E974													
N994 E974	40	5	1	48.0	0.57	0	0.00	0	0.00	2	0.03	0	0.00

Table 7-1a. Continued.

UNIT	FSN #	STR-TUM	FEA. #	VOL. (l)	WOOD WT (g)	CANE #	CANE WT. (g)	STEM #	STEM WT. (g)	HKRY NUT #	HKRY WT. (g)	JUGL NUT #	JUGL WT (g)
** Subtotal **				48.0	0.57	0	0.00	0	0.00	2	0.03	0	0.00
** N990 E1026													
N990 E1026	231	4	0	2.3	0.03	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1026	232	4	0	2.7	0.02	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1026	417	4	0	0.8	0.03	0	0.00	0	0.00	1	0.01	0	0.00
N990 E1026	418	4	0	0.5	0.01	0	0.00	0	0.00	0	0.00	0	0.00
N990 E1026	419	4	0	1.1	0.01	0	0.00	0	0.00	0	0.00	0	0.00
** Subtotal **				7.4	0.10	0	0.00	0	0.00	1	0.01	0	0.00
**			0	0.0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
** Subtotal **				0.0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
*** Total ***				1843	24.9	37	0.53	1	0.01	107	0.99	1	0.09

Table 7-1b. Contents of light franctions from the Dirst site (3MR80).

FSN #	UNID NUT #	UNID NUT WT.	ACRN SHLL #	ACRN WT. (g)	ACRN MEAT #	ACRN MEAT WT.	PEPO #	PEPO WT. (g)	MAIZ WT. (g)	CUP-ULE #	CPUL FRAG #	KRNL FRAG #	GLUM #	EMB RYO #	SEED #
** N990 E1010															
252	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	1
340	0	0.00	1	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	1
366	0	0.00	2	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	0
375	0	0.00	4	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	0
385	0	0.00	3	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	6
** Subtotal **															
	0	0.00	10	0.04	0	0.00	0	0.00	0.00	0	0	0	0	0	8
** N990 E1018															
213	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
264	0	0.00	1	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	1
337	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
** Subtotal **															
	0	0.00	1	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	1
** N990 E1020															
236	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
349	0	0.00	4	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	1
394	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	1
408	0	0.00	5	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	1
411	0	0.00	1	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	1
** Subtotal **															
	0	0.00	10	0.03	0	0.00	0	0.00	0.00	0	0	0	0	0	4
** N990 E1026															
275	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
298	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	1
316	0	0.00	0	0.00	1	0.11	0	0.00	0.00	0	0	0	0	0	0
327	0	0.00	0	0.00	0	0.00	1	0.01	0.00	0	0	0	0	0	2
288	0	0.00	5	0.01	0	0.00	6	0.02	0.00	0	0	0	0	0	17
** Subtotal **															
	0	0.00	5	0.01	1	0.11	7	0.03	0.00	0	0	0	0	0	20
** N990 E1028															
131	0	0.00	6	0.01	0	0.00	0	0.00	0.01	0	1	0	0	0	0
167	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
194	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	1
162	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
164	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
** Subtotal **															
	0	0.00	6	0.01	0	0.00	0	0.00	0.01	0	1	0	0	0	1
** N990 E1040															
294	0	0.00	2	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	2
311	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
** Subtotal **															
	0	0.00	2	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	2

Table 7-1b. Continued.

FSN #	UNID NUT #	UNID NUT WT.	ACRN SHLL #	ACRN WT. (g)	ACRN MEAT #	ACRN MEAT WT.	PEPO #	PEPO WT. (g)	MAIZ WT. (g)	CUP-ULE #	CPUL FRAG #	KRNL FRAG #	GLUM #	EMB RYO #	SEED #
** N998 E995															
363	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
372	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
388	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
** Subtotal **															
	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
** N1003E1020															
192	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
196	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
258	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
332	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
355	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
359	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
369	0	0.00	1	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	0
378	0	0.00	2	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	0
381	0	0.00	1	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	0
391	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
** Subtotal **															
	0	0.00	4	0.03	0	0.00	0	0.00	0.00	0	0	0	0	0	0
** N1003E1022															
223	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
225	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
** Subtotal **															
	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
** N1005E1020															
135	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
157	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	1
170	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
175	0	0.00	18	0.03	7	0.24	1	0.01	0.00	0	0	0	0	0	18
184	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	1
** Subtotal **															
	0	0.00	18	0.03	7	0.24	1	0.01	0.00	0	0	0	0	0	20
** N1005E1022															
187	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
204	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
291	0	0.00	0	0.00	0	0.00	0	0.00	0.01	0	1	0	0	0	0
238	0	0.00	155	0.31	2	0.14	1	0.01	0.02	1	3	0	0	0	37
241	0	0.00	98	0.11	0	0.00	5	0.03	0.08	3	8	1	3	1	71
245	0	0.00	128	0.21	0	0.00	2	0.01	0.03	0	9	2	4	0	29
** Subtotal **															
	0	0.00	381	0.63	2	0.14	8	0.05	0.14	4	21	3	7	1	137
** N994 E974															
40	1	0.01	1	0.01	18	0.06	1	0.01	0.00	0	0	0	0	0	6

Table 7-1b. Continued.

FSN #	UNID NUT #	UNID NUT WT.	ACRN SHLL #	ACRN WT. (g)	ACRN MEAT #	ACRN MEAT WT.	PEPO #	PEPO WT. (g)	MAIZ WT. (g)	CUP-ULE #	CPUL FRAG #	KRNL FRAG #	GLUM #	EMB RYO #	SEED #
** Subtotal **															
	1	0.01	1	0.01	18	0.06	1	0.01	0.00	0	0	0	0	0	6
** N990 E1026															
231	0	0.00	2	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	0
232	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
417	0	0.00	1	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	0
418	0	0.00	2	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	0
419	0	0.00	2	0.01	0	0.00	0	0.00	0.00	0	0	0	0	0	0
** Subtotal **															
	0	0.00	7	0.04	0	0.00	0	0.00	0.00	0	0	0	0	0	0
**															
	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
** Subtotal **															
	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0	0	0	0	0	0
*** Total ***															
	1	0.01	445	0.85	28	0.55	17	0.10	0.15	4	22	3	7	1	199

Table 7-1c. Contents of light franctions from the Dirst site (3MR80).

FSN #	UNID SEED FRAG	UN-KNOWN #	UNKN. WT. (g)	FUN-GAL #	FUN-GAL WT.	BONE #	BONE WT. (g)	SHELL WT. (g)	STONE/ SOIL WT.	SHERD #	SHERD WT. (g)	RESI-DUE WT.
** N990 E1010												
252	0	0	0.00	0	0.00	0	0.00	0.00	3.82	0	0.00	4.61
340	0	0	0.00	0	0.00	0	0.00	0.00	1.18	0	0.00	1.04
366	0	1	0.01	0	0.00	1	0.01	0.00	1.94	0	0.00	1.79
375	0	0	0.00	0	0.00	0	0.00	0.00	3.43	0	0.00	1.83
385	0	0	0.00	0	0.00	0	0.00	0.00	0.00	0	0.00	0.00
** Subtotal **												
	0	1	0.01	0	0.00	1	0.01	0.00	10.37	0	0.00	9.27
** N990 E1018												
213	0	0	0.00	0	0.00	0	0.00	0.01	11.08	0	0.00	6.67
264	0	0	0.00	0	0.00	0	0.00	0.00	3.79	0	0.00	2.26
337	1	0	0.00	0	0.00	0	0.00	0.00	4.93	0	0.00	2.44
** Subtotal **												
	1	0	0.00	0	0.00	0	0.00	0.01	19.80	0	0.00	11.37
** N990 E1020												
236	0	0	0.00	0	0.00	0	0.00	0.00	1.14	0	0.00	1.07
349	0	1	0.01	0	0.00	2	0.02	0.00	1.68	0	0.00	2.38
394	0	1	0.01	0	0.00	0	0.00	0.00	5.16	0	0.00	1.30
408	0	1	0.02	0	0.00	1	0.01	0.00	3.83	0	0.00	2.58
411	1	0	0.00	0	0.00	0	0.00	0.00	1.98	0	0.00	1.60
** Subtotal **												
	1	3	0.04	0	0.00	3	0.03	0.00	13.79	0	0.00	8.93
** N990 E1026												
275	0	0	0.00	1	0.01	0	0.00	0.00	8.53	0	0.00	6.85
298	0	1	0.01	0	0.00	0	0.00	0.08	9.09	0	0.00	6.76
316	0	0	0.00	0	0.00	0	0.00	0.09	3.64	0	0.00	2.40
327	0	0	0.00	0	0.00	0	0.00	0.06	1.32	0	0.00	1.17
288	9	9	0.05	0	0.00	0	0.00	0.76	69.16	0	0.00	47.70
** Subtotal **												
	9	10	0.06	1	0.01	0	0.00	0.99	91.74	0	0.00	64.88
** N990 E1028												
131	1	3	0.02	0	0.00	0	0.00	0.01	9.05	0	0.00	7.03
167	0	0	0.00	0	0.00	0	0.00	0.42	16.52	0	0.00	4.85
194	0	1	0.01	0	0.00	0	0.00	0.08	7.67	0	0.00	2.87
162	0	0	0.00	0	0.00	0	0.00	0.04	23.80	0	0.00	6.16
164	0	2	0.02	0	0.00	0	0.00	0.02	3.93	0	0.00	1.98
** Subtotal **												
	1	6	0.05	0	0.00	0	0.00	0.57	60.97	0	0.00	22.89
** N990 E1040												
294	1	1	0.01	1	0.01	0	0.00	0.00	12.60	0	0.00	6.58
311	0	0	0.00	0	0.00	0	0.00	0.00	2.70	0	0.00	1.51
** Subtotal **												
	1	1	0.01	1	0.01	0	0.00	0.00	15.30	0	0.00	8.09

Table 7-1c. Continued.

FSN #	UNID SEED FRAG	UN-KNOWN #	UNKN. WT. (g)	FUN-GAL #	FUN-GAL WT.	BONE #	BONE WT. (g)	SHELL WT. (g)	STONE/ SOIL WT.	SHERD #	SHERD WT. (g)	RESI-DUE WT.
** N998 E995												
363	0	1	0.01	0	0.00	0	0.00	0.00	6.04	0	0.00	3.43
372	0	0	0.00	0	0.00	0	0.00	0.00	2.38	0	0.00	4.34
388	0	0	0.00	1	0.02	0	0.00	0.00	1.65	0	0.00	1.68
** Subtotal **												
	0	1	0.01	1	0.02	0	0.00	0.00	10.07	0	0.00	9.45
** N1003E1020												
192	0	0	0.00	0	0.00	0	0.00	0.00	11.32	0	0.00	6.56
196	0	0	0.00	0	0.00	0	0.00	0.00	5.17	0	0.00	4.35
258	0	1	0.01	0	0.00	0	0.00	0.00	3.56	0	0.00	3.01
332	0	0	0.00	0	0.00	0	0.00	0.00	9.46	0	0.00	4.42
355	0	0	0.00	1	0.01	0	0.00	0.00	0.44	0	0.00	0.58
359	0	0	0.00	0	0.00	0	0.00	0.00	1.63	0	0.00	1.30
369	0	0	0.00	0	0.00	0	0.00	0.00	0.94	0	0.00	1.26
378	0	0	0.00	0	0.00	0	0.00	0.00	44.93	0	0.00	3.87
381	0	0	0.00	0	0.00	0	0.00	0.00	2.80	0	0.00	1.07
391	0	0	0.00	0	0.00	0	0.00	0.00	3.28	0	0.00	1.03
** Subtotal **												
	0	1	0.01	1	0.01	0	0.00	0.00	83.53	0	0.00	27.45
** N1003E1022												
223	0	0	0.00	0	0.00	0	0.00	0.00	6.36	0	0.00	5.67
225	0	0	0.00	0	0.00	0	0.00	0.00	6.35	0	0.00	2.72
** Subtotal **												
	0	0	0.00	0	0.00	0	0.00	0.00	12.71	0	0.00	8.39
** N1005E1020												
135	0	0	0.00	0	0.00	0	0.00	0.00	10.55	0	0.00	10.05
157	0	0	0.00	0	0.00	0	0.00	0.00	6.20	0	0.00	5.58
170	0	0	0.00	0	0.00	0	0.00	0.00	16.88	0	0.00	7.31
175	24	3	0.02	0	0.00	0	0.00	0.00	30.51	0	0.00	23.50
184	0	0	0.00	0	0.00	0	0.00	0.00	28.04	0	0.00	18.69
** Subtotal **												
	24	3	0.02	0	0.00	0	0.00	0.00	92.18	0	0.00	65.13
** N1005E1022												
187	0	0	0.00	0	0.00	0	0.00	0.00	16.18	0	0.00	7.94
204	0	0	0.00	0	0.00	0	0.00	0.00	11.85	0	0.00	7.80
291	0	0	0.00	0	0.00	0	0.00	0.06	2.65	0	0.00	2.75
238	42	95	0.42	2	0.01	5	1.34	62.24	65.85	0	0.00	66.53
241	29	60	0.27	0	0.00	5	0.62	2.36	31.99	1	0.02	34.04
245	17	40	0.20	1	0.01	1	0.01	0.00	47.36	0	0.00	35.84
** Subtotal **												
	88	195	0.89	3	0.02	11	1.97	64.66	175.88	1	0.02	154.9
** N994 E974												
40	7	0	0.00	0	0.00	0	0.00	0.21	25.25	0	0.00	16.[illegible]

Table 7-1c. Continued.

FSN #	UNID SEED FRAG	UN-KNOWN #	UNKN. WT. (g)	FUN-GAL #	FUN-GAL WT.	BONE #	BONE WT. (g)	SHELL WT. (g)	STONE/ SOIL WT.	SHERD #	SHERD WT. (g)	RESI-DUE WT.
** N998 E995												
363	0	1	0.01	0	0.00	0	0.00	0.00	6.04	0	0.00	3.43
372	0	0	0.00	0	0.00	0	0.00	0.00	2.38	0	0.00	4.34
388	0	0	0.00	1	0.02	0	0.00	0.00	1.65	0	0.00	1.68
** Subtotal **												
	0	1	0.01	1	0.02	0	0.00	0.00	10.07	0	0.00	9.45
** N1003E1020												
192	0	0	0.00	0	0.00	0	0.00	0.00	11.32	0	0.00	6.56
196	0	0	0.00	0	0.00	0	0.00	0.00	5.17	0	0.00	4.35
258	0	1	0.01	0	0.00	0	0.00	0.00	3.56	0	0.00	3.01
332	0	0	0.00	0	0.00	0	0.00	0.00	9.46	0	0.00	4.42
355	0	0	0.00	1	0.01	0	0.00	0.00	0.44	0	0.00	0.58
359	0	0	0.00	0	0.00	0	0.00	0.00	1.63	0	0.00	1.30
369	0	0	0.00	0	0.00	0	0.00	0.00	0.94	0	0.00	1.26
378	0	0	0.00	0	0.00	0	0.00	0.00	44.93	0	0.00	3.87
381	0	0	0.00	0	0.00	0	0.00	0.00	2.80	0	0.00	1.07
391	0	0	0.00	0	0.00	0	0.00	0.00	3.28	0	0.00	1.03
** Subtotal **												
	0	1	0.01	1	0.01	0	0.00	0.00	83.53	0	0.00	27.45
** N1003E1022												
223	0	0	0.00	0	0.00	0	0.00	0.00	6.36	0	0.00	5.67
225	0	0	0.00	0	0.00	0	0.00	0.00	6.35	0	0.00	2.72
** Subtotal **												
	0	0	0.00	0	0.00	0	0.00	0.00	12.71	0	0.00	8.39
** N1005E1020												
135	0	0	0.00	0	0.00	0	0.00	0.00	10.55	0	0.00	10.05
157	0	0	0.00	0	0.00	0	0.00	0.00	6.20	0	0.00	5.58
170	0	0	0.00	0	0.00	0	0.00	0.00	16.88	0	0.00	7.31
175	24	3	0.02	0	0.00	0	0.00	0.00	30.51	0	0.00	23.50
184	0	0	0.00	0	0.00	0	0.00	0.00	28.04	0	0.00	18.69
** Subtotal **												
	24	3	0.02	0	0.00	0	0.00	0.00	92.18	0	0.00	65.13
** N1005E1022												
187	0	0	0.00	0	0.00	0	0.00	0.00	16.18	0	0.00	7.94
204	0	0	0.00	0	0.00	0	0.00	0.00	11.85	0	0.00	7.80
291	0	0	0.00	0	0.00	0	0.00	0.06	2.65	0	0.00	2.75
238	42	95	0.42	2	0.01	5	1.34	62.24	65.85	0	0.00	66.53
241	29	60	0.27	0	0.00	5	0.62	2.36	31.99	1	0.02	34.04
245	17	40	0.20	1	0.01	1	0.01	0.00	47.36	0	0.00	35.84
** Subtotal **												
	88	195	0.89	3	0.02	11	1.97	64.66	175.88	1	0.02	154.9
** N994 E974												
40	7	0	0.00	0	0.00	0	0.00	0.21	25.25	0	0.00	16.78

Table 7-2a. Hand picked or screened plant remains from the Dirst site.

FSN #	STRA -TUM	FEA. #	WOOD WT.	CANE #	CANE WT.	STEM #	STEM WT.	HKRY #	HKRY WT.	WALNT #	WALNT WT.	JGLND #	JGLND WT.
44	5	1	0.14	0	0.00	0	0.00	33	1.11	2	0.20	8	0.06
110	5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
129	5	0	0.52	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
155	5	0	0.22	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
166	LF	0	0.28	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
168	5	0	0.22	0	0.00	0	0.00	0	0.00	1	0.09	0	0.00
171	5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
205	5	0	0.14	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
211	5	0	0.00	0	0.00	0	0.00	1	0.07	0	0.00	0	0.00
219	5	0	0.13	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
240	LF	4	1.93	0	0.00	0	0.00	41	1.67	0	0.00	0	0.00
262-13	5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
265	5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
266	5	0	0.01	0	0.00	0	0.00	0	0.00	0	0.00	6	0.04
273-12	4	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
276	5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
287	5	2	0.26	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
296	5	0	0.20	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
305-10	LF	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
314-3	LF	0	0.38	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
314-5	LF	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
314-6	LF	0	0.00	1	0.06	0	0.00	0	0.00	0	0.00	0	0.00
314-11	LF	0	0.24	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
314-12	LF	0	0.14	1	0.01	0	0.00	0	0.00	0	0.00	0	0.00
314-14	LF	0	0.07	0	0.00	0	0.00	1	0.07	0	0.00	0	0.00
314-15	LF	0	0.11	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
325-2	4	0	0.00	0	0.00	0	0.00	2	0.03	3	0.05	0	0.00
325-5	4	0	0.07	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
325-12	4	0	0.11	1	0.17	0	0.00	0	0.00	0	0.00	0	0.00
325-14	4	0	0.46	0	0.00	0	0.00	1	0.02	0	0.00	0	0.00
325-15	4	0	0.11	0	0.00	0	0.00	1	0.03	0	0.00	0	0.00
335-2	LF	0	0.09	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
335-10	LF	0	0.04	1	0.06	0	0.00	4	0.13	0	0.00	0	0.00
335-8	LF	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
335-14	LF	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
338-3	LF	0	0.03	0	0.00	0	0.00	0	0.00	0	0.00	14	0.07
338-8	LF	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
347-3	LF	0	1.02	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
347-6	LF	0	0.83	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
347-7	LF	0	0.14	0	0.00	0	0.00	0	0.00	6	0.12	0	0.00
347-9	LF	0	0.05	0	0.00	0	0.00	1	0.08	0	0.00	0	0.00
347-10	LF	0	0.29	0	0.00	0	0.00	1	0.08	0	0.00	0	0.00
347-11	LF	0	0.28	0	0.00	0	0.00	0	0.00	1	0.11	0	0.00
347-13	LF	0	0.00	0	0.00	1	0.55	0	0.00	0	0.00	0	0.00
347-16	LF	0	0.12	0	0.00	0	0.00	1	0.14	0	0.00	0	0.00
364-4	5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	30	0.20
364-5	5	0	0.44	0	0.00	0	0.00	0	0.00	0	0.00	6	0.07
364-12	5	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
374	3	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
286	5	2	0.80	0	0.00	0	0.00	0	0.00	1	0.07	0	0.00
420	5	2	5.10	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
174	LF	4	2.72	3	0.20	0	0.00	29	1.10	0	0.00	0	0.00
233	LF	4	1.80	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
237	LF	4	0.79	0	0.00	0	0.00	4	0.38	0	0.00	0	0.00
244	LF	4	4.00	0	0.00	0	0.00	1	0.01	0	0.00	0	0.00
421	LF	4	5.98	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
*** Total ***			30.26	7	0.50	1	0.55	121	4.92	14	0.64	64	0.44

Table 7-2b. Hand picked or screened plant remains from the Dirst site.

FSN #	FEA. #	ACORN SHLL#	ACORN WT.	ACORN MEAT#	ACORN MT.WT	PRSIMN SEED #	PRSIMN SEEDWT	UNK. #	UNK. WT.	BONE #
44	1	0	0.00	0	0.00	0	0.00	2	0.02	1
110	0	0	0.00	0	0.00	0	0.00	0	0.00	0
129	0	0	0.00	0	0.00	0	0.00	0	0.00	0
155	0	0	0.00	0	0.00	0	0.00	0	0.00	0
166	0	0	0.00	0	0.00	0	0.00	0	0.00	0
168	0	0	0.00	0	0.00	0	0.00	0	0.00	0
171	0	0	0.00	0	0.00	0	0.00	0	0.00	0
205	0	0	0.00	0	0.00	0	0.00	0	0.00	1
211	0	0	0.00	0	0.00	0	0.00	0	0.00	3
219	0	0	0.00	0	0.00	0	0.00	0	0.00	0
240	4	2	0.01	3	0.19	0	0.00	1	0.03	0
262-13	0	0	0.00	0	0.00	0	0.00	0	0.00	0
265	0	0	0.00	0	0.00	0	0.00	0	0.00	0
266	0	0	0.00	0	0.00	0	0.00	0	0.00	4
273-12	0	0	0.00	0	0.00	1	0.07	0	0.00	0
276	0	0	0.00	0	0.00	0	0.00	0	0.00	0
287	2	0	0.00	0	0.00	0	0.00	0	0.00	2
296	0	0	0.00	0	0.00	0	0.00	0	0.00	0
305-10	0	0	0.00	0	0.00	0	0.00	0	0.00	0
314-3	0	0	0.00	0	0.00	0	0.00	0	0.00	0
314-5	0	0	0.00	0	0.00	0	0.00	0	0.00	0
314-6	0	0	0.00	0	0.00	0	0.00	0	0.00	0
314-11	0	0	0.00	0	0.00	0	0.00	0	0.00	0
314-12	0	0	0.00	0	0.00	0	0.00	0	0.00	1
314-14	0	0	0.00	0	0.00	0	0.00	0	0.00	0
314-15	0	0	0.00	0	0.00	0	0.00	0	0.00	0
325-2	0	0	0.00	0	0.00	0	0.00	0	0.00	0
325-5	0	0	0.00	0	0.00	0	0.00	0	0.00	0
325-12	0	0	0.00	0	0.00	0	0.00	0	0.00	0
325-14	0	0	0.00	0	0.00	0	0.00	0	0.00	0
325-15	0	0	0.00	0	0.00	0	0.00	0	0.00	0
335-2	0	0	0.00	0	0.00	0	0.00	0	0.00	0
335-10	0	0	0.00	0	0.00	0	0.00	0	0.00	0
335-8	0	0	0.00	0	0.00	0	0.00	0	0.00	0
335-14	0	0	0.00	0	0.00	0	0.00	0	0.00	0
338-3	0	0	0.00	0	0.00	0	0.00	0	0.00	0
338-8	0	0	0.00	0	0.00	0	0.00	1	0.13	0
347-3	0	0	0.00	0	0.00	0	0.00	0	0.00	0
347-6	0	0	0.00	0	0.00	0	0.00	0	0.00	0
347-7	0	0	0.00	0	0.00	0	0.00	0	0.00	0
347-9	0	0	0.00	0	0.00	0	0.00	0	0.00	0
347-10	0	0	0.00	0	0.00	0	0.00	0	0.00	0
347-11	0	0	0.00	0	0.00	0	0.00	0	0.00	0
347-13	0	0	0.00	0	0.00	0	0.00	0	0.00	0
347-16	0	0	0.00	0	0.00	0	0.00	0	0.00	0
364-4	0	0	0.00	0	0.00	0	0.00	0	0.00	0
364-5	0	0	0.00	0	0.00	0	0.00	0	0.00	0
364-12	0	0	0.00	0	0.00	0	0.00	0	0.00	0
374	0	0	0.00	0	0.00	0	0.00	0	0.00	0
286	2	0	0.00	0	0.00	0	0.00	0	0.00	0
420	2	0	0.00	0	0.00	0	0.00	0	0.00	0
174	4	4	0.03	5	0.70	1	0.10	0	0.00	0
233	4	0	0.00	0	0.00	0	0.00	0	0.00	0
237	4	4	0.08	0	0.00	1	0.08	0	0.00	0
244	4	0	0.00	5	0.19	0	0.00	0	0.00	3
421	4	4	0.11	0	0.00	0	0.00	0	0.00	0
*** Total ***		14	0.23	13	1.08	3	0.25	4	0.18	15

Museum of Anthropology by Gayle J. Fritz and Sandra L. Dunavan. The quantities reported in the tables of this report represent fragments larger than 2.0 mm in size, except for acorn shell--which includes all fragments larger than 1.18 mm in size--and maize, cucurbit rind, and seeds, which include all recognizable specimens. For the samples having wood charcoal, cane stem, or nutshell represented only in the smaller-than-2.0 mm geological screen sizes, a weight of 0.01 g and count of 1 fragment was entered.

The sorted categories other than seeds were weighed to the nearest 0.01 g on an OHAUS digital electronic balance. Summed weights of acorn shell, cucurbit rind, and fungal matter are not meaningful, since many samples contained fragments totaling less than .005 g in weight that were recorded as 0.01 g. All plant categories other than wood charcoal were counted as well as weighed. Residue weights include fragments smaller than 2.0 mm but larger than 0.71 mm after removal of acorn shell, maize fragments, seeds, and materials not represented in the larger-than-2.0 mm sieve sizes.

The immediately apparent problem with the flotation assemblage is the low density of archaeobotanical remains in general. Carbonized fragments of any kind were few and far between in all but a few exceptional samples. The analysts suspected that the midden and most features must have been poor in plant remains or else that flotation recovery was not very effective. The presence of much more dirt, stone, and uncarbonized vegetal matter than is customary in light fractions made sorting more difficult and time consuming than usual. For this reason, the top midden level in each unit (Stratum 5, Level 1) was not included in the analysis. Level 1 samples were unduly full of troublesome extraneous matter and especially poor in carbonized fragments.

Interpretive potential is limited by small overall sample sizes. Heavy fractions should be examined in order to ascertain whether or not certain types of materials were systematically missed by light fraction recovery. The low number of hickory nutshell fragments, in particular, may be due primarily to failure of these relatively dense, heavy fragments to clear the overflow spout. If so, they will be represented in the heavy fractions. Relatively high counts of hickory nutshell fragments in the hand picked and screened samples support the speculation that these items are underrepresented in the light fractions due to recovery problems.

During preliminary analysis, one sample from Feature 2 (FSN 288) and two from Feature 4 (FSN 238 and 245) were subsampled by pouring the contents through a metal raffle-type sample splitter, and only 50 percent from each was analyzed. Due to the presence of interesting seed types and maize fragments, the remaining portions have subsequently been analyzed in full. Four light fractions from Control Unit BT-4 have also been analyzed but are not included in this report, which deals only with the Lower Midden area.

Outline of Provenience and Chronology

Cultural deposits at the Dirst site reflect prehistoric occupation as early as the Dalton period and as late as the Emergent Mississippian period. Archaeological strata can be summarized as follows:

Stratum 5. A midden rich in animal bones and artifacts typical of late Middle-Late Woodland periods and Emergent Mississippian times.

Living Floor. A rock strewn surface at the base of the Stratum 5 midden that is contiguous with it (actually being the lower part of the midden) and is viewed as dating to the Middle-Late Woodland period. A large pit feature--Feature 4--originated at this level.

Stratum 4. An organically enriched Early Woodland period deposit underlying the Living Floor.

Stratum 3. A layer containing diagnostic Late Archaic lithic artifacts underlying Stratum 4.

Stratum 2. Sediments containing Early to Middle Archaic projectile points and other stone tools and fragments.

Stratum 1b. A deeply buried paleosol overlying Pleistocene gravels, the earliest cultural stratum at the site, yielding two Dalton-type projectile points, two Graham Cave lanceolate points, and an Early Archaic Rice Lobed point.

It was initially hoped that the contents of samples from strata of different ages would indicate temporal trends in plant use for the central Ozark region. The low absolute counts and weights of plant remains, especially for strata below the Living Floor, made this virtually impossible. Stratum 1b, for example, yielded no plant food remains. Feature 4, however, a large pit originating at the level of the Living Floor in Units N1005/E1020 and N1005/E1022 provided a very good context for subsistence reconstruction during Middle-Late Woodland times. A total of 657 liters of soil were floated from this feature, and significant types of plant foods including maize and starchy seeds were identified.

Contents of Light Fraction Samples

Wood Charcoal, Cane Stem, and Other Stem. The total weight of wood charcoal recovered from light fractions is 24.91 g, 21.25 g of which came from the four Feature 4 flotation samples. Charcoal weight is low considering the large soil volumes floated. The average density (weight of wood greater than 2 mm in size divided by soil volume) outside of Feature 4, at 0.031 grams per 10 liters, is extremely low. Even the light fractions from the Stratum 5 midden with its abundant faunal remains and artifactual debris contained few archaeobotanical remains of any taxon.

Thirty-seven fragments of cane (Arundinaria gigantea) stem weighing a total of 0.53 g were present in Dirst site samples. Twenty-two of these came from Feature 4 and an additional 14 came from Feature 2, a basin shaped area within the Stratum 5 midden characterized by somewhat darker matrix with abundant artifacts, fire baked clay nodules, shell, and fire cracked rocks. The only other cane stem fragment was found in

the sample with FSN 291, in the same unit and stratum as Feature 4. Cane tends to be a good indicator of domestic activities and is frequently closely associated with structures, where it was used in wall supports and where mats and baskets were concentrated. Its presence in Feature 2 strengthens the likelihood that this area was the edge of a burned and collapsed structure.

One fragment of unidentified stem material came from Feature 4, FSN 175.

Nutshell. Thick hickory nutshell (Carya spp.) was present in 13 (22.8 percent) of the Dirst site light fraction samples, with a total count of 107 fragments and total weight of 0.99 g. Feature 4 was again the primary contributor, yielding 96 of the fragments and 0.84 grams of the weight. Small numbers of hickory nutshell fragments were present in the Stratum 5 midden, on the Living Floor outside of Feature 4, and in Strata 4 and 3 (see Table 7-3), but none were found in the samples from Strata 2 or 1b.

Fourteen pieces of nutshell weighing a total of 0.14 g were classified as Juglandaceae (walnut family) to signify that they might have come from either hickory nuts or walnuts. The presence of walnut shell (Juglans nigra) in hand picked and screened samples enhances the likelihood that walnut is also represented in the light fractions, but by fragments too small for good recognition. Two Juglandaceae fragments came from Stratum 5, eight from Feature 4, two from Stratum 4, and two from Stratum 2. Feature 1 (FSN 40) contained one unidentified nutshell fragment.

Acorn shell (Quercus spp.) is the most abundant and most ubiquitous food plant type in the light fraction samples, being present in 23 (40.4 percent) of the samples, with a total count of 445 fragments larger than 1.18 mm. The summed weight of 0.85 g is an exaggeration resulting from assigning a weight of 0.01 g to samples where the one or few acorn shell fragments actually weighed less than 0.005 g. Feature 4 accounts for 399 of the acorn shell fragments, but acorn was distributed throughout the Stratum 5 midden (18 pieces), the Living Floor outside Feature 4 (4 pieces), Stratum 4 (13 pieces), Stratum 3 (8 pieces), and Stratum 2 (3 pieces, including one from FSN 381, classified as Stratum 2-1b). Fragments of acorn nutmeat were present in four samples, all but one of which also contained acorn shell. Total count of acorn nutmeat fragments is 28; total weight is 0.55 g. Most acorn nutmeat came from Feature 1 and Feature 4.

Given the low frequencies of plant remains outside of Feature 4, it is probably unwise to speculate about increasing or decreasing importance of acorn through time. Furthermore, the relative abundance of acorn shell compared to hickory and other nutshell at 3MR80 may be distorted by limited flotation recovery effectiveness. Since hickory nutshell is much more dense, most is probably in the unanalyzed Heavy Fractions. Still, acorn shell frequency is sufficiently high (6.1 fragments per 10 liters in Feature 4) to suggest intense harvesting of this rich source of carbohydrates, or alternatively, relative abundance of oak trees and/or scarcity of hickories in this section of the Buffalo River. The implications of intensive acorn harvesting in regional perspective will be discussed below.

Table 7-3. Plant foods from Dirst site light fractions.

FSN #	Fea. #	STRA -TUM	HCKRY SHELL #	HCKRY WT. (g)	JUGL. NUT #	JUGL. WT. (g)	ACORN SHELL #	ACORN SHELL WT.	PEPO #	PEPO WT. (g)	MAIZE WT. (g)	SEED #
252	0	5	0	0.00	0	0.00	0	0.00	0	0.00	0.00	1
340	0	5	0	0.00	0	0.00	1	0.01	0	0.00	0.00	1
366	0	5	0	0.00	0	0.00	2	0.01	0	0.00	0.00	0
375	0	3	1	0.01	0	0.00	4	0.01	0	0.00	0.00	0
385	0	3	0	0.00	0	0.00	3	0.01	0	0.00	0.00	6
213	0	5	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
264	0	5	0	0.00	0	0.00	1	0.01	0	0.00	0.00	1
337	0	LF	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
236	0	5	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
349	0	LF	1	0.02	0	0.00	4	0.01	0	0.00	0.00	1
394	0	4	0	0.00	0	0.00	0	0.00	0	0.00	0.00	1
408	0	4	0	0.00	2	0.01	5	0.01	0	0.00	0.00	1
411	0	4	0	0.00	0	0.00	1	0.01	0	0.00	0.00	1
275	0	5	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
298	0	5	0	0.00	0	0.00	0	0.00	0	0.00	0.00	1
316	0	LF	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
327	0	4	0	0.00	0	0.00	0	0.00	1	0.01	0.00	2
288	2	5	2	0.04	0	0.00	5	0.01	6	0.02	0.00	17
131	0	5	0	0.00	1	0.01	6	0.01	0	0.00	0.01	0
167	0	5	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
194	0	4	0	0.00	0	0.00	0	0.00	0	0.00	0.00	1
162	2	5	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
164	3	5	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
294	0	5	0	0.00	0	0.00	2	0.01	0	0.00	0.00	2
311	0	5	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
363	0	2a	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
372	0	2a	0	0.00	2	0.02	0	0.00	0	0.00	0.00	0
388	0	1b	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
192	0	5	1	0.01	0	0.00	0	0.00	0	0.00	0.00	0
196	0	5	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
258	0	LF	1	0.01	0	0.00	0	0.00	0	0.00	0.00	0
332	0	4	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
355	0	3	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
359	0	3	1	0.01	0	0.00	0	0.00	0	0.00	0.00	0
369	0	3	0	0.00	0	0.00	1	0.01	0	0.00	0.00	0
378	0	2	0	0.00	0	0.00	2	0.01	0	0.00	0.00	0
381	0	2-1B	0	0.00	0	0.00	1	0.01	0	0.00	0.00	0
391	0	1b	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
223	0	5	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
225	0	5	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
135	0	5	0	0.00	1	0.01	0	0.00	0	0.00	0.00	0
157	0	5	0	0.00	0	0.00	0	0.00	0	0.00	0.00	1
170	0	LF	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
175	4	LF	9	0.08	0	0.00	18	0.03	1	0.01	0.00	18
184	6	5	0	0.00	0	0.00	0	0.00	0	0.00	0.00	1
187	0	5	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
204	0	5	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
291	0	LF	1	0.01	0	0.00	0	0.00	0	0.00	0.01	0
238	4	LF	44	0.43	8	0.04	155	0.31	1	0.01	0.02	37
241	4	LF	23	0.21	0	0.00	98	0.11	5	0.03	0.08	71
245	4	LF	20	0.12	0	0.00	128	0.21	2	0.01	0.03	29
40	1	5	2	0.03	0	0.00	1	0.01	1	0.01	0.00	6
231	0	4	0	0.00	0	0.00	2	0.01	0	0.00	0.00	0
232	0	4	0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
417	0	4	1	0.01	0	0.00	1	0.01	0	0.00	0.00	0
418	0	4	0	0.00	0	0.00	2	0.01	0	0.00	0.00	0
419	0	4	0	0.00	0	0.00	2	0.01	0	0.00	0.00	0
	0		0	0.00	0	0.00	0	0.00	0	0.00	0.00	0
*** Total ***			107	0.99	14	0.09	445	0.85	17	0.10	0.15	199

Cucurbita pepo Rind. The rind of "squash" or gourd--Cucurbita pepo--occurred in seven light fraction samples, for a total count of 17 recognizable fragments. One of these came from Feature 1, six from Feature 2, and nine from Feature 4 samples. The remaining pepo rind fragment was in FSN 327, from Stratum 4. Archaeobotanists have not determined how to distinguish between the prehistoric varieties and cultivar types of the species C. pepo using the tiny carbonized rind fragments from open sites. A relatively dry and hard rind--discarded after having been used as a container or after mature seeds were removed for consumption--is more likely to become preserved by burning than an immature fleshy squash type of rind.

Maize. Maize (Zea mays ssp. mays) was clearly present at 3MR80, probably reflecting adoption of this cultigen into the already developing food production component of the Late Woodland (or possibly late Middle Woodland) subsistence system. Fragments of cobs or kernels were present in five samples. The maize assemblage consists of four whole cupules, 22 cupule fragments, seven glumes, four of which are probable but not definite, one nearly whole kernel and two possible kernel fragments, and a possible embryo (germ) fragment. Feature 4 yielded all of the maize with the exception of two cupule fragments, one of which came from FSN 131 in Stratum 5 and the second from FSN 291, a Living Floor sample near Feature 4.

Widths of the entire cupules are 7.6 mm, 6.5 mm, 6.4 mm, and 6.1 mm. Projected measurements of the nearly complete kernel are 5.8 mm for width and 4.7 mm for thickness. Kernel height could not be estimated for this fragment. It is not possible to identify the row number, "race", or endosperm type of maize from a few fragmentary charred specimens such as these.

The significance of the 3MR80 maize is its very presence in pre-Mississippian samples. The exact age of Feature 4 fill is important in this regard, since A.D. 800 is something of a benchmark in Eastern Woodlands maize intensification. After this date, maize occurs in greater numbers in archaeobotanical assemblages from numerous sites. Before this date, maize is uncommon. The 3MR80 maize density is low enough to fit the pre-800 A.D. pattern, but any pre-Emergent Mississippian site where maize rises above the minimum level of archaeological visibility is significant.

The two radiocarbon age determinations from Feature 4 indicate that maize was in use at the Dirst site in the central Ozarks before A.D. 800. The large standard deviation from Beta 33079 (1650 +/- 210 B.P.) reduces the assay's precision and usefulness, but the 95 percent confidence interval (uncalibrated) of 120 B.C. to A.D. 720 still predates the Emergent Mississippian period. Beta 33080 has a 95 percent confidence interval of A.D. 380 to 700, pinning down the likely age of the feature to the late Middle Woodland or the Late Woodland. Direct AMS dating of maize from Feature 4 would be necessary to dispel any doubt of its intrusion from the slightly later occupation of the overlying midden deposits.

Middle Woodland maize has been substantiated through direct AMS dating from the Icehouse Bottom site in eastern Tennessee (Chapman and Crites 1987) and from the Edwin Harness mound near Chillicothe, Ohio (Ford 1987). Maize in apparently good Middle Woodland context--but not directly dated--has been

reported from the Holding site in the American Bottom (Parker 1989) and from the Walling site, a Copena mound in northern Alabama (Scarry 1987). Late Middle Woodland components in central Tennessee have also yielded maize (Crites 1978). In all of these cases, the material is highly fragmented and limited in quantity.

Maize continues to be relatively uncommon in Late Woodland components in the Eastern Woodlands. In westcentral Illinois, small amounts of maize begin to appear in Late Woodland contexts, but N. Asch and D. Asch (1978) consider the early Late Woodland occurrences unreliable due to low level contamination from later components. At only one pre-Emergent Mississippian site have considerable amounts of maize been recovered. Thirty percent of the features belonging to the Patrick phase (A.D. 600-800) component at the Sponemann site in the American Bottom yielded maize fragments, with the total counts exceeding 650 (Parker 1988).

Intensification of maize agriculture occurred during Emergent Mississippian phases (A.D. 800-1000) in the American Bottom area and at the end of the contemporaneous West Jefferson phase in westcentral Alabama (Johannessen 1984 and 1988; Scarry 1988). Emergent Mississippian components in Missouri and northeast Arkansas also reflect an increased visibility of maize (Voigt 1986; Morse and Morse 1983), but the levels of consumption for most members of the society appear to have remained low (Lynott et al. 1986). The lower Mississippi Valley and Arkansas River Valley may not have participated in pre-Mississippian maize intensification: quantities recovered from Plum Bayou phase components are minimal (Fritz 1988a). The Dirst site maize count is already higher than the total of four cupules from rich middens on Mounds B, D, and E at the Toltec Mounds site. Single features such as Feature 4 at 3MR80 can yield disproportionate quantities of any given item, but I would guess that the Late Woodland occupation at Dirst fits into the mid-latitude pattern of increasing maize acquisition, whereas Lower Mississippi Valley societies did not incorporate maize production until later, if at all (Rose et al. 1984; Fritz and Ramenofsky 1989).

Seeds. The mixed subsistence economy at the Dirst site included native starchy and oily seed husbandry in addition to wild fruit and nut harvesting and the production of maize and pepo gourd and/or squash. A total of 199 seeds came from the light fraction samples.

Feature 4 was the primary source of seeds with a count of 155, but that feature's seed assemblage is not as rich as might be expected given the large volume of soil floated. Total seed counts and densities do not approach those of seed concentrations recovered from Woodland through early Mississippian pits in Tennessee and Illinois. The relatively rich Feature 4 had a mean ratio of only 2.4 seeds per ten liters of soil processed by flotation, as compared to means of up to 39.8 seeds/10 l, excluding pits with exceptionally dense seed concentrations, for Late Woodland components in the American Bottom area (Johannessen 1984).

The most abundant seed type at the Rush site is little barley (Hordeum pusillum), with a total of 62 specimens, all from Feature 4 (Table 7-4). I suspect that a number of the 112 eroded, poorly preserved

Table 7-4. Seeds from Dirst site light fractions.

FSN #	F. #	STR #	Ha	Ia	Hp	Pc	P.	Cs	Cb	Cj	CA	As	Pe	Ps	Gs	Po	Em	C.	Pu	Dv	Vs	Rs	At
** FEATURE # 0																							
131	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
157	0	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
252	0	5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
264	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
294	0	5	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
298	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
340	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
337	0	LF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
349	0	LF	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
194	0	4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
327	0	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
394	0	4	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
408	0	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
411	0	4	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
385	0	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
** Subtotal **																							
			0	0	0	2	1	2	0	0	1	2	0	1	1	0	0	0	0	1	1	1	0
** FEATURE # 1																							
40	1	5	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
** Subtotal **																							
			1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
** FEATURE # 2																							
288	2	5	0	0	0	0	0	2	6	1	0	0	0	0	1	0	0	0	0	0	2	0	2
** Subtotal **																							
			0	0	0	0	0	2	6	1	0	0	0	0	1	0	0	0	0	0	2	0	2
** FEATURE # 6																							
184	6	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
** Subtotal **																							
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
** FEATURE # 4																							
175	4	LF	0	0	2	2	0	0	1	0	0	4	0	1	0	6	0	0	0	0	0	0	0
238	4	LF	0	0	13	1	1	4	0	0	0	2	2	0	0	0	0	3	1	0	1	0	0
241	4	LF	0	2	41	6	1	4	0	0	3	0	0	0	1	0	3	1	0	1	0	0	0
245	4	LF	0	0	6	5	1	0	1	0	0	4	0	0	0	3	0	0	0	0	3	0	0
** Subtotal **																							
			0	2	62	14	3	8	2	0	3	10	2	1	1	9	3	4	1	1	4	0	0
*** Total ***																							
			1	2	62	16	4	13	9	1	4	12	2	2	3	9	3	4	1	2	7	1	2

"unidentifiable seed fragments" in Feature 4 also represent little barley. This species is recognized as a member of the native Eastern North American starchy seed crop complex, but no firm evidence of genetic modifications that would have transformed the grain from cultivated to truly domesticated status has been observed. Little barley is abundant in Woodland and Mississippi period archaeobotanical assemblages in Illinois, Wisconsin, Iowa, Missouri, Arkansas, and Oklahoma. Its absence from desiccated Ozark rockshelter samples is significant. I have speculated that a casual cultivation regime (seed scattering while harvesting) not entailing seed stock storage may have been practiced (Fritz 1986).

Two other members of the native starchy seed crop complex are represented in small numbers in Feature 4. Fourteen maygrass (Phalaris caroliniana) caryopses were identified. Ten chenopod (Chenopodium spp.) seeds were present along with 3 poorly preserved specimens classified as Cheno-Am due to the impossibility of identifying them as either chenopod or amaranth. Only two of the ten chenopod seeds depart from the weedy morphological type, and these are not well enough preserved to firmly classify them as the domesticated taxon, C. berlandieri ssp. jonesianum. One is puffed and missing its seed coat in a manner typical of the thin-testa domesticates and very atypical of wild or weedy thick-testa chenopod types. The second has clearly truncate margins but no visible seed coat. This would make it a good candidate for the pale-seeded, huauzontli-type of grain grown in the Ozarks by the time of occupation represented in Feature 4 (Fritz 1986; Fritz and Smith 1988). Little can be concluded, however, from small, poorly preserved assemblages such as this one.

The fourth native starchy seed type--knotweed (Polygonum erectum)--may be represented in Feature 4 by two trigonous Polygonum fragments and one Polygonaceae specimen, but the identification is clearly tenuous. Two seed fragments are possibly from domesticated sumpweed kernels (Iva annua *var. macrocarpa*), but, again, preservation is not good enough for firm classification.

Adventitious seed types expected to have been present in gardens and disturbed habitation areas include ten amaranth (Amaranthus sp.), nine purselane (Portulaca oleraceae), three spurge (Euphorbia maculata), four morning glory family (Convovulaceae), and one bedstraw (Galium sp.). Two fragments (counted as one seed) of persimmon (Diospyros virginiana) and four grape seeds (Vitis sp.) reflect collection of native fruits. One bearsfoot (Polymnia uvedalia) seed was also recovered, along with three unidentified grass (Poaceae) caryopses. The Feature 4 seed assemblage also contains 25 unidentified seeds, most of which are in poor condition.

Seed counts are low outside Feature 4 (see Table 7-4). Six seeds came from Feature 1, 17 from Feature 2, and one (unidentified) from Feature 6. Non-feature light fractions yielded a total of 20 seeds. The most common taxon outside of Feature 4 is chenopod with 13 specimens. Five of these are classified as Chenopodium sp. (species undetermined), and seven as C. berlandieri on the basis of their reticulate seed coats. Another (from Feature 2) is the thin-testa, truncate margin C. berlandieri ssp. jonesianum, with a diameter of 1.2 mm. Two of the chenopod specimens in the Chenopodium sp. group, both from Feature 2, might also be from a cultigen variety since no seed coat is visible under low magnification, but both are small (1.0 and 1.1 mm

diameters) and look poorly developed. The others, however, including those classified as C. berlandieri but not as C. berlandieri ssp. jonesianum, appear to be wild or weedy types with thick seed coats and biconvex rather than truncate or puffed up sides. One Cheno-Am and two amaranth seeds were present in various non-Feature 4 samples. Maygrass was represented by two caryopses outside of Feature 4, and one knotweed achene (Polygonum sp.) was observed. A sunflower kernel (Helianthus annuus *var. macrocarpus*) from Feature 1 is in the cultigen size range (7.4x3.4 mm, not correcting for carbonization).

Other seeds include two ragweed (Ambrosia trifida) kernels, both from Feature 2, two bedstraw (Galium sp.), three grape (Vitis sp.), one possible persimmon seed fragment (Diospyros virginiana), one sumac (Rhus sp.), one grass (Poaceae) 14 unidentified seeds, and 20 unidentifiable fragments.

The low seed counts inhibit statements about continuity or change in seed use through time. When counts of oily and starchy seed crop taxa are combined, considering the assemblage from the site as a whole, they constitute 54 percent of the total seeds. When Feature 4 is isolated, starchy and oily seeds constitute 59 percent of total seeds.

Hand Picked and Screened Plant Remains

Fifty-six samples of plant remains recovered by troweling or quarter-inch-screening are tabulated in Table 7-2. Wood charcoal was present in 38 samples. The total weight of wood is 30.26 g, 17.22 g of which came from Feature 4 samples. Cane stem was present in five samples, with a total count of 7 fragments and total weight of 0.50 g. Only three of the cane culm fragments came from Feature 4. None came from Feature 2. One sample consisted of an unidentified stem fragment weighing 0.55 g.

One hundred and twenty-one pieces of thick hickory nutshell weighing a total of 4.92 g were included in the hand picked or screened samples, reinforcing the impression that hickory nutshell was significantly under-represented in the light fractions and might be much more abundant in the unanalyzed heavy fractions. Feature 4 accounted for 75 of the hickory nut fragments, weighing 3.16 g. Fourteen walnut shell fragments were distributed across six samples, weighing a total of 0.64 g. Surprisingly, Feature 4 contained no recognizable walnut shell. Four walnut fragments came from Stratum 5 samples, seven from the Living Floor, and three from Stratum 4. Highly fragmented Juglandaceae nutshell was present in five samples, with a total count of 64 and total weight of 0.44 g.

Acorn shell was only present in four hand picked or screened samples, all from Feature 4, with the 14 pieces weighing 0.23 g. Carbonized acorn shell is so fragile that its presence at all among these larger items is attributable to its abundance in the Feature. Thirteen fragments of acorn meat were present, again, all coming from Feature 4.

The only seeds included in these samples of larger items were three persimmon seeds, two of which came from Feature 4 and the third from the Stratum 4 sample with FSN 273-12.

Discussion of Subsistence in Regional Perspective

Light fraction samples from proveniences at 3MR80 antedating the Middle-Late Woodland Living Floor level held too few archeobotanical remains to allow subsistence reconstruction. Stratum 4, with Early Woodland period associations, yielded a single hickory nutshell fragment, two Juglandaceae fragments, 13 acorn shell pieces, one fragment of pepo rind, and six seeds: one maygrass, one chenopod, one amaranth, one knotweed, one bedstraw, and one unidentified.

Samples from the Late Archaic Stratum 3 component held only two pieces of hickory nutshell and eight of acorn shell along with six seeds (all from the same sample): one chenopod and five unidentified. Strata 2 and 2a, when combined, yielded only five food plant fragments: two of Juglandaceae nutshell and three of acorn shell. The Dalton-Early Archaic Stratum 1b samples contained no food plant remains (Table 7-3).

Fortunately, samples from Feature 4 and, to a lesser extent, the overlying Stratum 5 midden included archeobotanical remains allowing interpretations pertaining to Late Woodland (or Middle-Late Woodland) and early Mississippi period subsistence. Broadly characterizing the diet, there seems to have been a focus on high carbohydrate plant foods: acorns and native starchy seed crops, with a relatively early incorporation of small scale maize production. Hickory nuts and walnuts were also utilized, but appear to be underrepresented in light fractions because of the flotation recovery process. Oily seeds--sunflower, possibly sumpweed, and probably the seeds from Cucurbita pepo--were likely to have been much more important than reflected in the carbonized archaeological record.

The abundance of acorn shell and the husbandry of starchy seeds and maize would be consistent with Scott's (this volume) interpretation of the Dirst site faunal remains from Stratum 5 as indicating a degree of difficulty in procuring quality (i.e., high fat) meat, a difficulty which she attributes to the rugged physiography of the region. Plants high in carbohydrates might be utilized more intensively if local deer were unusually lean, a possible correlate of the extreme muscle development and high rate of tooth wear observed on numerous deer bones. The overall faunal assemblage does not indicate subsistence stress, but the deer and elk elements are noteworthy by suggesting unusually thorough utilization of animals killed.

I would, however, hesitate to view the high carbohydrate diet that can be inferred from the Dirst site archeobotanical assemblage as resulting from local geographical factors. Elsewhere in the midsouth and midwest, even in wide major river valley systems, starchy seed husbandry was intensified during the Middle Woodland or early Late Woodland period (Yarnell and Black 1985; Fritz 1988b) and, in some regions, it continued to be intensified as farmers produced maize in quantity for the first time during the Emergent Mississippian (Lopinot 1988; Johannessen 1989). Starchy seed counts at 3MR80 are not high enough to demonstrate that they were heavily utilized, but the numerous examples of native chenopod and maygrass specimens in storage context and dated to the Woodland through early Mississippi period from Ozark rock-

shelters show that many Middle to Late Woodland period Ozark societies did participate in serious native starchy seed husbandry (Fritz 1986).

Frequencies of acorn nutshell rose dramatically in the Emergent Mississippian phases in the American Bottom, continuing the trend toward higher percentages of acorn nutshell that began during previous Late Woodland phases (Johannessen 1984; 1988). Acorn was also abundant during the Late Woodland West Jefferson phase in the Black Warrior River Valley, but without evidence for major native starchy seed husbandry (Scarry 1986). The Dirst site, then, can not be described as regionally anomalous in having relatively high frequencies of acorn or other carbohydrate sources. The need for additional carbohydrates--whether acorns or starchy seed crops or both--is viewed elsewhere in the context of rising population densities that may be correlated with longterm agricultural developments (cf. Rindos 1984; Braun 1987; Buikstra et al. 1986) and with increasing social control beyond the local kin group level (Johannessen 1988).

It is not unreasonable to think that plant use in the Buffalo River Valley was in many ways similar to the pattern reconstructed for other midlatitude riverine systems. The basic regime of gathering and gardening seen at the Dirst site is clearly repeated at the temporally overlapping (primarily Emergent Mississippian) Gooseneck and Owls Bend sites on the eastern Ozark border of southeast Missouri (Voigt 1986; Lynott 1989). At all of these sites, nuts, fruits, and wild seed types were associated with the native starchy and oily seed crops, cucurbits, and small quantities of maize. The Dirst site starchy seed counts and maize counts exceed those of both Gooseneck and Owls Bend, probably because only limited flotation was conducted during excavation of the Missouri sites. The initial evidence of Middle-Late Woodland period paleoethnobotany as revealed by the Dirst site samples, especially the light fractions from Feature 4, indicates that gardening and nut harvesting practices were on a parallel if not common pathway with those of contemporary societies in northeast Arkansas, Missouri, and Illinois.

Zooarcheological Remains from 3MR80-Area D

SUSAN L. SCOTT

Introduction

More than 10,000 animal bones were recovered during excavations at 3MR80-Area D, most of them in the Stratum 5 midden deposit that dates to the Middle to Late Woodland period. Generally speaking, bone from the site was in very good condition, allowing identification at least to the taxonomic level of Class for nearly 7,500 pieces. In the general excavation units, bone preservation was best in N990/E1026-1028, with the density of bone markedly decreased in neighboring excavation units. Feature deposits generally yielded good samples of bone; this is particularly true of Feature 4 in N1005/E1020-1022. Although samples of bone from the earlier occupations at 3MR80-Area D are insufficiently large to allow firm interpretation, the Late Woodland sample appears to be quite reliable, as will be discussed in more detail below.

Taphonomy

The objective of zooarcheological research is to interpret faunal remains from an anthropological perspective. A prerequisite to accurate interpretation of the assemblages archaeologists recover, however, is recognition of those cultural and noncultural factors which have enhanced or discouraged bone preservation, thereby biasing the sample. These biases fall into two general categories: 1) inaccurate representation of certain taxa in relation to others, and 2) skewing in the relative frequency of skeletal elements within a taxon. For both categories, the largest single contributor to variability is the relative density of skeletal elements. However, when dealing with datasets ultimately generated by cultural practices, further complications in interpretation ensue.

Human behavior, both conscious and unconscious, determines the subset of bones that survive the ravages of time and consumption. By burying food refuse, humans are in fact geological agents, unintentionally facilitating bone preservation by decreasing the amount of time the bones are exposed to physical weathering. Such helpful actions do not necessarily ensure a representative sample of animal remains, however. An ethnoarcheologically observed example of bias resulting from unintentional human behavior is the frequent subsurface migration of identifiable small animal bones as a result of trampling. These studies have shown that small animals are likely to be disproportionately represented in samples of bones from heavily trafficked areas such as living floors (Gifford 1977, 1980; Gifford and Behrensmeyer 1978; Yellen 1977).

Determination of intentional human behavior is, of course, the goal of faunal analysis. Interpretation is complicated, however, by the numerous cultural decisions and chance events affecting the composition of an assemblage. Under the guise of cultural behavior, parts of an animal may be left at the site of the kill, may be dismembered in a patterned, predictable fashion, may be distributed to friends and relatives, and the bones may be processed beyond recognition in attempting to extract as much sustenance from the animal as possible. The cultural rules governing such behaviors may be lax or specific depending on the taxon involved and the degree of desperation being experienced in subsistence pursuits (cf. Binford 1978).

Following this patterned, but no doubt somewhat erratic, set of behaviors, the bones may or may not be buried through cultural or natural processes. If left exposed, they will be dispatched either quite quickly by dogs or other scavengers, or slowly deteriorate due to weathering. If buried, they may dissolve eventually anyway through the action of soil acids in combination with alternating wet and dry postdepositional conditions.

The foregoing discussion is meant to stand as both a disclaimer and a caution to those who might place too much confidence in the reliability of the interpretations to follow. Although every bone assemblage is a palimpset of numerous intentional decisions and sheer accidents, every archaeologist faces precisely this kind of complexity in almost any analytical pursuit. In comparison with other samples similarly collected and analyzed, one hopes that the "average" behavior will be apparent.

In the specific case of bone deposits at 3MR80-Area D, postdepositional conditions appear to have markedly influenced only the older deposits. No bone was found associated with the Dalton component, and the sample from Strata 3 and 4 consisted of only three identifiable bones (all relatively dense large mammal fragments). The Stratum 5 living floor deposits may have suffered some attrition, but generally appear to be intact. The Stratum 5 midden deposits appear to be extremely reliable.

Most bone fragments from the site were permineralized, presumably as a result of mineral rich groundwater. The limestone bedrock underlying the archaeological deposits coupled with a thick blanket of alluvium no doubt created nearly ideal postdepositional conditions at the site. Nonacidic pH and relatively stable groundwater conditions provided a very stable postdepositional environment which should be conducive to bone preservation at the site far into the future. Consequently, every effort should be made to avoid disturbing intact archaeological deposits during future construction.

Determining the reliability of the 3MR80-Area D sample in terms of culture based refuse discard patterns is more difficult. Because the artifact bearing deposits are deeply buried, only a tiny area of the site was actually sampled during excavation. General matrix samples from the "living floor" may have produced an over-representation of small animals, due to reasons discussed above. Only future excavations at this site and others dating to the same time period can clarify how representative this small sample is of actual exploitation patterns. Likewise, the midden sample may suffer from sampling error in the placement of excavation units,

with disproportionate representation of certain types of refuse features. Again, this uncertainty exists for all classes of archaeological materials, and may be cleared up only with additional excavation at the site.

Carnivore and rodent gnawed bone was rare in this assemblage. Three carnivore gnawed deer and large mammal elements were recovered in Late Woodland midden/features, and a single gnawed deer calcaneum was found on the living floor. The infrequency of carnivore gnawed bone suggests either that few dogs were present on the site, or that the dogs present were ravenous, successfully polishing off every scrap they obtained. One of the fragments (a distal deer first phalanx) was found in Feature 4, emphasizing the secondary nature of the deposit. Only two rodent gnawed bones were discovered, a large mammal rib fragment in N990/E1028, and a distal tibiotarsus identified as turkey from N990/E1028. Rodents are unlikely to account for much attrition at this site.

Materials and Methods

Bone fragments from 3MR80-Area D were identified by comparison with specimens in the author's reference collection, or collections made available by the University of Southern Mississippi, or the Museums of Anthropology and Zoology at the University of Michigan. Data recorded include taxon (to the most specific level possible given the surviving morphological characteristics of the fragment), element, symmetry, degree of epiphyseal fusion, modification (burning, gnawing, butchering marks), and weight (in grams). For large mammal and deer remains, degree of fragmentation was recorded in addition to the other variables, and for identifiable fish, length of the individual was estimated. All deer teeth were aged with the use of an aged series of Odocoileus virginianus borealis specimens collected at the George Reserve, in Michigan, and kindly made available by the Mammal Division of the University of Michigan Museum of Zoology.

The Analysis: Subsistence and Seasonality

At least 17 species were identified in the small living floor sample, and at least 37 were present in the midden deposits (see Tables 8-1 and 8-2). Although both samples are relatively diverse considering their size, in actuality, most of the meat represented comes from white tail deer and elk, with all other taxa playing only a supplemental role in the subsistence economy. Precisely which species were of secondary importance is impossible to ascertain with the small living floor sample. For the Late Woodland, wild turkey, beaver, raccoon, and interestingly, softshell turtle, all appear to have been relatively frequently exploited species judging from NISP, MNI, and Ubiquity Indices (see Table 8-3 for ubiquity data). Although box turtle fragments outnumber softshell fragments, their relatively low ubiquity on the site suggests their frequency is more likely a result of their use as containers than as subsistence items.[1] Aquatic taxa do not appear to have played more

1. Ubiquity measures the degree of dispersal across a site, i.e., the number of separate proveniences yielding a particular taxon. Viewing ubiquity as a measure of importance requires the assumption that the occurrences are independent of each other, which is reasonable particularly for small animals not likely to have been shared beyond the family group.

Table 8-1. Count (NISP), weight (in grams), and minimum number of individuals for taxa identified in the Dirst site deposits (3MR80-Area D).

	Stratum 5			Living Floor			Stratum 4		
Taxon	NISP	g	MNI	NISP	g	MNI	NISP	g	MNI
Raccoon	13 (2)	5.7	3						
Skunk	1	0.5	1						
Mink	1 (1)	0.3	1						
Fox	1 (1)	0.2	1						
Dog	4	1.7	1						
Rabbit	1	0.2	0						
Cottontail	2	0.6	1						
Squirrel	3	0.4	0						
Gray squirrel	9 (1)	0.4	1						
Fox squirrel	6	2.5	1						
Chipmunk	1	0.5	1						
Woodchuck	2	1.3	1						
Pocket gopher	3	0.7	1						
Rat/mouse	1	0.1	1						
Beaver	17	12.4	1						
Muskrat	3	0.9	1	1	0.1	1			
Unid. rodent	1	0.2	0						
Deer	521 (45)	1610.3	7	96 (4)	363.9	2			
Elk	25 (1)	231.2	2	5	66.9	1			
Very lg mammal	62 (14)	31.5	0	2	2.6	0			
Large mammal	3269 (1114)	1755.0	0	480 (157)	310.5	0	3	5.9	1
Med/sm mammal	120 (24)	30.1	0	49 (7)	11.9	0			
Subtotal mammal	4066 (1203)	3688.3	25	633 (168)	755.9	4	3	5.9	1
Turkey	29 (4)	58.4	2	3	14.8	1			
Large bird	213 (34)	86.3	0	47 (6)	18.6	0			
Med/sm bird	318 (77)	51.3	1	19 (4)	3.1	1			
Subtotal bird	560 (115)	196.0	3	69 (10)	36.5	2			
Snapping turtle	11 (1)	8.2	2	2					
Softshell turtle	73 (17)	24.6	3	2	0.9	1			
Mud/musk turtle	25 (3)	6.1	2	4 (1)	1.3	1			
Pond turtle	36 (2)	31.8	3	8 (1)	4.9	1			
Box turtle	108 (7)	106.2	9	16 (1)	9.7	1			
Unid. turtle	1433 (385)	314.6	0	223 (66)	55.5	0			
Subtotal turtle	1686 (415)	493.0	19	253 (69)	72.3	4			

Table 8-1. Continued.

	Stratum 5			Living Floor			Stratum 4		
Taxon	NISP	g	MNI	NISP	g	MNI	NISP	g	MNI
Racer-like snake	8	2.1	1						
Kingsnake	10 (2)	1.7	1						
?Pinesnake	1	0.5	1						
Nonpoisonous	4	0.6	0	1	0.2	1			
Viper	3	1.2	1	1	0.2	1			
Unid. snake	9 (3)	1.8	0	1	0.3	0			
Subtotal snake	34 (5)	7.4	4	3	0.7	2			
Frog/toad	2	0.4	1	2	0.4	1			
Subtotal amphibian	2	0.4	1	2	0.4	1			
Gar	8 (1)	2.0	2						
Minnow	1	0.3	1						
Sucker	9	1.3	1						
Hognose	7	1.2	2						
Redhorse	7	2.1	4	1	0.2	1			
Catfish	2	0.6	0	1	0.2	1			
Channel catfish	3	2.9	2						
Flathead	3	1.0	1						
Perchlike	1 (1)	0.2	0	1	0.2	1			
Sunfish family	13 (1)	1.5	2						
Bass	3	0.5	2	1	0.4	1			
Sunfish	2	0.4	1						
?Drum	1 (1)	0.1	1						
Unid. fish	62 (6)	6.3	0	6	0.7	0			
Subtotal fish	122 (10)	20.4	19	10	1.7	4			
Total ID'ed	6470 (1758)	4405.5	71	969 (247)	867.6	17	3	5.9	1
Unid. bone	3413 (747)	501.5		534 (121)	60.0	2.6			

Numbers in parentheses indicate the number of burned bones in each category.

Table 8-2. Species list for faunal remains from 3MR80-Area D.

Common name	Scientific name
Raccoon	Procyon lotor
Striped skunk	Mephitis mephitis
Mink	Mustela vison
Gray Fox	Urocyon cinereoargenteus
Dog	Canis cf. familiaris
Rabbit	Sylvilagus sp.
Cottontail	S. floridanus
Squirrel	Sciurus sp.
Gray squirrel	S. carolinensis
Fox squirrel	S. niger
Chipmunk	Tamius striatus
Pocket gopher	Geomys bursarius
Woodchuck	Marmota monax
Beaver	Castor canadensis
Muskrat	Ondatra zibethecus
Mouse/rat	Cricetidae
Unid. rodent	Rodentia
Whitetail deer	Odocoileus virginianus
Elk	Cervus canadensis
Turkey	Meleagris gallopavo
Snapping turtle	Chelydridae
Mud/musk turtle	Kinosternidae
Softshell turtle	Trionyx sp.
Pond turtle	Chrysemys/Graptemys
Box turtle	Terrapene sp.
Nonpoisonous snake	Colubridae
Racer/Coachwhip	Coluber/Masticophis
Kingsnake	Lampropeltis/Elaphe
?Pinesnake	cf. Pituophis melanoleucus
Frog/toad	Anura
Gar	Lepisosteus sp.
Minnow	Cyprinidae
Sucker	Catostomidae
Hogsucker	Hypentelium nigricans
Redhorse	Moxostoma sp.
Catfish	Ictaluridae
Channel catfish	Ictalurus punctatus
Flathead catfish	Pylodictis olivaris
Perchlike fish	Perciformes
Sunfish family	Centrarchidae
Bass	Micropterus sp.
Sunfish	Lepomis sp.
?Rockbass	cf. Ambloplites rupestris
?Freshwater drum	cf. Aplodinotus grunniens

Table 8-3. Ubiquity (number of discrete occurrences) for taxa identified at 3MR80-Area D.

Taxon	Living Floor # occurrences	Midden # occurrences
Raccoon	0	5
Skunk	0	1
Mink	0	1
Fox	0	1
Dog	0	2
Rabbit	0	1
Cottontail	0	2
Squirrel	0	1
Gray squirrel	0	4
Fox squirrel	0	3
Chipmunk	0	1
Woodchuck	0	2
Pocket gopher	0	1
Rat/mouse	0	1
Beaver	0	5
Muskrat	1	1
Unid. rodent	0	1
Deer	5	13
Elk	3	9
Large mammal	4	2
Med/small mammal	3	5
Turkey	2	7
Large bird	1	5
Med/small bird	0	9
Snapping turtle	0	5
Softshell turtle	0	8
Mud/musk turtle	2	5
Pond turtle	2	6
Box turtle	3	6
Unid. turtle	5	13
Racer/Coachwhip	0	4
Kingsnake	0	4
?Pinesnake	0	1
Viper	1	2
Unid. snake	1	2
Frog/toad	0	2
Gar	0	4
Minnow family	0	1
Hogsucker	0	3
Redhorse	1	3

Table 8-3. Continued.

Taxon	Living Floor # occurrences	Midden # occurrences
Catfish	1	1
Channel catfish	0	1
Flathead catfish	0	1
Sunfish family	0	1
Sunfish	0	1
Bass	1	3
?Rockbass	0	1
?Drum	0	1
Unid. fish	1	3

than a very minor role in the subsistence economy, a fact that is no surprise considering the size and nature of the Buffalo River.

The site probably was occupied year-round. Two buck frontals were recovered in midden samples, one with and one without antlers. The frontal with antlers was recovered from general midden deposit in N990/E1026 and indicates exploitation during the autumn/early winter. The frontal exhibiting shed antlers was recovered in Feature 3 indicating a late winter/early spring date for that deposit. Included in the small sample from Feature 3 were small quantities of small mammal, small-medium bird, pond and other unidentifiable turtle, snake, and fish bone. Deer and large mammal bone contributed 96 percent by weight to the sample, indicating that subsistence pursuits were still relatively focused at this time of year. The presence of fish and mussels at the site in the Woodland period samples suggests occupation during the summer (cf. Swanton 1946:342).

The spread in the size ranges represented among the fish in the midden assemblage (Table 8-4), along with the kinds of species present, suggests a nonselective fishing technology was used. No concentration on any particular size range is apparent, a pattern expected with the use of nets or traps. Rather, fishers appear to have been opportunistic, and may have taken advantage of slackwater pools during dry summers or made use of rock weirs in upland streams. Living floor deposits yielded insufficient numbers of identifiable fish to speculate on the technology employed. Two of four identifiable fish bones were identifiable only to suborder (Perciformes, 20-40 cm SL) or family (Ictaluridae, 20-40 cm SL), and the remaining two bones also represent medium-sized fish (Micropterus sp., 35-40 cm SL; and Moxostoma sp., 20-25 cm SL).

Table 8-4. Estimated sizes (standard length, in cm) of individual fish in Stratum 5, 3MR80-Area D.

Taxon	0-10	10-20	20-25	25-30	30-35	35-40	40-50	50-60	>60
Gar*								1	1
Minnow		1							
Sucker						1			
Redhorse				1	1		1	1	
Hogsucker				1	1				
Channel cat.						1		1	
Flathead						1			
Sunfish fam.	1			1					
Sunfish			1						
Bass					1	1			
Rock bass		1							
?Drum							1		
Total	1	2	1	3	3	4	2	3	1

* Estimated lengths for gar are total length, and are based on Longnose Gar (Lepisosteus osseus) specimens.

Deer and Elk Utilization

Together, deer and elk contributed most of the meat in the diet of the 3MR80-Area D inhabitants. Judging from the elements recovered in the midden sample, each deer and elk brought to the site was fully utilized--down to the last marrow bone. Furthermore, very little field dressing appears to have been practiced, indicating either procurement near the base camp, or an exceptionally high regard for venison, resulting perhaps from the difficulty procurement must have entailed in the surrounding mountains.

Although each animal was fully utilized, considerable selectivity in prey may be indicated by the age structure represented in the sample. Most of the bone recovered appeared to be from full-grown, adult deer. In fact, the extent of tooth wear coupled with exceptionally rugose muscle attachments on long bones suggest that the deer themselves led a rather hardscrabble life in trying to obtain sustenance in the central Ozarks. Minimally three deer under the age of 2 years are present, three and probably considerably more between the ages of 2 and 7 are present, and at least two deer older than 7 years were identified in the sample. Of the young deer, only one fawn under the age of 6 months was identified; the age estimate is based on the size and spongy texture of a carpal from a young individual. All remaining estimates are based on tooth eruption and wear (following Severinghaus 1949). Many of the deer were quite large (estimated to exceed 45 kg/100 lb), and far more teeth from adults were identified, suggesting that procurement focused on quantity of meat rather than tenderness.

Toughness is also suggested by the number and depth of butchering marks found on the bones themselves. Butchering marks were observed on the ascending ramus of a mandible in 990/1026, presumably to cut through and remove the masseter muscle. Skinning marks surrounded an antler pedicel in Feature 3, which also yielded numerous butchering marks on an astragalus (for disarticulating the hindlimb at the hock). Two other astragali from 990/1026 yielded butchering marks as well, one from the midden assemblage, the other from underlying living floor. A distal humerus from the same unit was scored repeatedly in disarticulating the forelimb at the "elbow." Finally, an ilium fragment from Feature 4 had various butchering marks along the medial portion of the element, opposite and slightly superior to the acetabulum, presumably made while stripping meat from the pelvis. Nearly all of these marks were repeated two or more times, and most were quite deep, as if considerable force was required to sever the muscle.

At least one young (less than 6 months?) elk was present in the sample. Again a single carpal from an immature individual was found in the sample. All remaining elk bone appeared to be from adults in the size range of female wapiti from Wyoming (based on the comparative material available at the University of Michigan). The sex of the individuals represented is impossible to ascertain, however, without a larger sample. It is possible that the resident elk population in the Ozarks was on the small side.

The relative frequency of deer elements for both midden and living floor deposits is shown in Table 8-5. Minimum number of elements was calculated without regard for symmetry, as per the recommendation of Binford (1978), since such consideration may inflate the actual number of animals present. Also included in Table 8-5 is the difference between the observed relative frequency of deer elements and the relative frequency of elements one would expect to survive based solely on bone density (taken from Binford's "survival percentages" 1981:218, Column 7).

Both samples differ significantly from the expected survival frequencies. For the living floor sample, much if not most of the variation may pertain to sampling error; the sample is simply too small to provide a reliable basis for interpretation. On the other hand, the midden sample also differs quite markedly from the expected survival percentages, often exceeding the expected survival rate. Basically, the high values for many deer elements indicate that the midden sample is very well preserved, and attrition has been minimal.

Because of the generally good preservation, the few examples of negative numbers in Table 8-5 require consideration since they presumably are a result of cultural behavior. For both midden and living floor samples, the low representation of skull parts is spurious. Binford calculated density for maxilla and mandibles with the teeth in association. When compiling data for Table 8-4, only relatively complete mandibles and maxilla were included, a fact which has far underestimated their actual frequency based on loose teeth. The remaining negative numbers, particularly for long bones such as the distal radius, distal femur, and distal tibia all suggest that vigorous cultural processing of these parts has rendered them unidentifiable. Each of these elements would have provided good quality bone grease (cf. Binford 1978: 32-38). Alternatively, if the customary cooking practice was to roast the meat attached to these elements as is suggested by some of the observed

Table 8-5. Minimum number and relative frequency of deer elements from 3MR80-Area D deposits.

	Living Floor			Midden		
Element	MNI	%	+/1 Exp%	MNI	%	+/- Exp%
Maxilla	0		-80	1.5	33	-47
Mandible	2.0	80	-20	3.0	67	-34
Atlas	0		-71	3.0	67	-4
Axis	2.0	80	+26	4.0	89	+35
Cervical vertebra	0.2	8	-23	1.6	36	+5
Thoracic vertebra	0.2	8	-28	1.0	22	-14
Lumbar vertebra	0.2	8	-41	2.4	53	+4
Ribs*	0.2	8	-17	1.8	40	+15
Dist. scapula	0		-54	2.5	56	+2
Prox humerus	2.5	100	+83	1.5	22	+5
Dist humerus	1.0	40	-18	3.0	67	+9
Prox radius	0.5	20	-21	3.5	78	+37
Dist radius	0		-50	0.5	11	-39
Ulna	0.5	20	n/a	1.5	33	n/a
Carpals	0.5	20	-5	1.8	40	+15
Metacarpal	1.5	60	+24	2.5	56	+20
Pelvis	0.5	20	-68	4.5	100	+12
Prox femur	0		-40	4.0	88	+48
Dist femur	0		-35	1.0	22	-13
Prox tibia	1.0	40	+15	2.0	44	+19
Dist tibia	0		-71	2.0	44	-27
Tarsals	0.3	12	-28	2.5	56	+16
Astragalus	1.0	40	+4	4.0	88	+52
Calcaneum	1.0	40	+4	2.5	56	+20
Metatarsal	0.5	20	-21	2.0	44	+3
Phalanx 1	0.4	16	-1	2.0	44	+27
Phalanx 2	0.4	16	+3	0.9	20	+7
Phalanx 3	0.1	4	-6	0.9	20	+10

* Includes identifiable only as large mammal in addition to deer.

patterning in charred elements (see below), the low representation of these bones may be a result of subsequent accidental breakage, since charring renders the bone more brittle.

The low representation of thoracic vertebrae in the midden sample also suggests differential destruction during butchering or consumption. It may be that thoracic vertebrae were destroyed through either of the

means suggested above (intentionally for grease or accidentally through charring if the rib slab was customarily roasted), or during the process of butchering the animal. Many of the identifiable vertebrae, including at least one relatively complete thoracic vertebrae, appeared to have been chopped with some cleaver-like tool during butchering, as has been observed at archeological sites on the Plains (cf. Frison 1978).

Bone breakage at the site was consistently high for both midden and living floor assemblages (Tables 8-6 and 8-7), with between 75 and 80 percent of all identifiable deer bone reduced to less than one quarter of their original size. If all large mammal fragments were included in these calculations the number would be significantly higher since such fragments are so reduced that the element usually can no longer be identified. Even phalanges were broken to obtain the tiny bit of marrow in them. Such extensive breakage suggests full utilization of the animal--meat, marrow, and bone grease--and suggests some degree of frugality, as is frequently true of aboriginal assemblages.

Although elk elements were too rare in the assemblage to warrant tabulation, they were treated similarly. All parts of the animal are present on the site: skull, long bones, feet, and axial skeleton, indicating very little field dressing was practiced, and all were reduced to less than a quarter of their original size, indicating that processing was thorough.

The relative frequency of charred fragments of specific deer elements is shown in Table 8-8. By and large, the frequency of burned fragments at the site is low for both midden and living floor assemblages. Deer and other bone was more consistently burned during the later occupation of the site, perhaps because the resident population was larger, and putrefying garbage was more of a social affront. Excluding lumbar vertebrae, most of the relatively frequently burned elements are those of the feet: metapodials, carpals, tarsals, and phalanges. This pattern suggests an attempt to dispose of low quality parts in a relatively expeditious manner at least occasionally during the Late Woodland period. Interestingly, the percentage of burned foot elements consistently approaches 25 percent. The burned elements are possibly those from individuals procured during relatively warm periods of the year. Although infrequently charred, many of the meatier longbones (femur, tibia) exhibited charring primarily in areas which would have been exposed during roasting over an open fire. Cooking meat in this way may have been more than an occasional practice.

Discussion

The picture which emerges from this analysis of faunal remains suggests that the prehistoric occupants of 3MR80-Area D may have experienced some degree of hardship in trying to obtain meat in the central Ozarks, but the hardship probably stemmed more from the physiography of the region than from food shortages. The faunal component of the subsistence economy focused on the procurement and full utilization of large mammals, particularly white tail deer, and secondarily, elk.

Table 8-6. Degree of fragmentation of deer and large mammal* skeletal elements from living floor, 3MR80-Area D.

Element	<1/4	1/4-1/2	1/2-3/4	3/4-Complete
Misc. skull	4			
Maxilla	0			
Mandible	6			
Atlas	0			
Axis		1		1
Cervical vertibra	1			
Thoracic vertibra	2			
Lumbar vertibra	1			
Unid. vertibra*	1			
Ribs	21			
Scapula	0			
Humerus	5	2		
Radius	2			
Ulna	1			
Carpals			2	
Metacarpal	4			
Pelvis		1		
Femur	3	1		
Tibia	2			
Tarsals		1		1
Astragalus	1			1
Calcaneum			2	
Metatarsal	2			
Metapodial	3			
Phalanx 1	1	3		
Phalanx 2	5			
Phalanx 3	1			1
Phalanx 1/2	4			
Sesamoid	0			

Total frags. (NISP) 87** (excludes teeth and rarely encountered elements.
* Includes most rib and unidentifiable vertebra fragments.

Table 8-7. Degree of fragmentation of deer and large mammal* skeletal elements from midden deposits at 3MR80-Area D.

Element	<1/4	1/4-1/2	1/2-3/4	3/4-Complete
Misc. skull	27			
Maxilla	3			
Mandible	16	1		
Atlas	1	1	1	
Axis		4		
Cervical vertibra	3	4	1	
Thoracic vertibra	10	2		
Lumbar vertibra	11	1		1
Unid. vertibra*	22			
Ribs	57	1		
Scapula	3	4		
Humerus	6	4		
Radius	8	3		
Ulna	9			
Carpals			1	8
Metacarpal	10	1		
Pelvis	12	2		
Femur	18	1		
Tibia	17	2		
Tarsals	1	3	2	10
Astragalus	2		3	3
Calcaneum	6	5	1	1
Metatarsal	22	1		
Metapodial	21	1		
Phalanx 1	15	6	4	3
Phalanx 2	8	4		
Phalanx 3	2	3	2	3
Phalanx 1/2	12			
Sesamoid				9

Total frags. (NISP) 429 (excludes teeth and rarely encountered elements.
* Includes most rib and unidentifiable vertebra fragments.

Table 8-8. Relative frequency of charred deer and large mammal* skeletal elements from 3MR80-Area D deposits.

Element	Living floor % burned	Midden % burned
Maxilla		0
Mandible	14	0
Atlas		0
Axis	0	0
Cervical vertibra	0	0
Thoracic vertibra	0	0
Lumbar vertibra	0	46
Unid. vertibra*	0	9
Ribs*	5	7
Scapula		0
Humerus	0	0
Radius	0	9
Ulna	0	33
Carpals	0	11
Metacarpal	0	0
Pelvis	0	7
Femur	0	16
Tibia	0	11
Tarsals	0	25
Astragalus	0	25
Calcaneum	0	23
Metatarsal	0	26
Metapodial	100	24
Phalanx 1	0	7
Phalanx 2	0	17
Phalanx 3	0	10
Phalanx 1/2	23	50
Sesamoid		22

* Includes fragments identified only as large mammal.

Most of each deer and elk procured appears to have been returned to the site, where it was completely utilized. If the relative frequency of deer elements is plotted against Binford's "Modified General Utility Index," or MGUI, the pattern of exploitation clearly falls into the "bulk" rather than the "gourmet" category. The Modified General Utility Index is a relative value assigned to each bone which takes into consideration its meat, marrow, and bone grease quantity and quality, as well as the probability the element will be transported because of its location between two elements of higher utility. A "bulk" strategy suggests some degree of economic hardship, or at least frugality, because regardless of utility, most of each animal was returned to the site. Transport of deer carcasses in the central Ozarks no doubt required considerable effort, and likely would have involved more than one person, further suggesting that each kill was highly regarded.

Other important faunal resources include turkey, raccoon, beaver, and softshell turtle during the Late Woodland period. None of these species occurs in sufficient quantity to suggest an emphasis on second-line resources, such as might be expected under famine conditions. That the Middle-Late Woodland population was well within the carrying capacity of their environment is also suggested by the degree of selectivity practiced in deer procurement. Full grown adults in their prime apparently were the desired prey, yielding relatively large packages of meat per hunting effort. If the subsistence base of the aboriginal population was precarious, it is unlikely that such selectivity would have been practiced.

Judging from the osteological condition of the deer procured, the resident deer population also may have found the task of obtaining food labor intensive, and at times difficult. An extremely high rate of tooth wear on all of the individuals observed in the sample suggests some degree of unselectiveness in foodstuffs, and extreme muscle development on a number of deer specimens suggests travel in search of food was rigorous. Together, these facts may indicate that the deer procured were somewhat tough, and perhaps lean as well. If the deer procured were exceptionally lean, the shortage of animal fat in the aboriginal diet might have played some role in the shift toward increased carbohydrate consumption inferred from the high caries rate of Late Woodland populations (Sabo et al. 1988). Such a hypothesis might be borne out by evidence for increased consumption of fatty animals, oily plant foods, and carbohydrates in Late Woodland assemblages (cf. Speth and Spielmann 1983 for a discussion of the role of fat in aboriginal diets).

Only one other site in the Central Ozarks has yielded faunal remains: the Mississippian period component at the Elk Track site (Lafferty et al. 1988b), which is compared with animal bone assemblages from the Dirst site in Table 8-9. Unfortunately, the sample from the Elk Track site is extremely small (only about half the size of the Early Woodland sample from the Dirst site), and somewhat biased because of the inclusion of two nearly complete box turtle carapaces (cf. Scott 1988:200, Table 39). If the artificially inflated weight for turtle in the assemblage is discounted, the assemblage is not appreciably different from the Early and Late Woodland assemblages from the Dirst site. All appear to have hunting economies focused on the procurement of large mammals, although fish may have been more important resources at the Elk Track site. Whether or not the proportions of large mammal remained similar throughout the 2,000 year period thus far documented must await larger samples of remains.

Table 8-9. Relative contribution of taxonomic classes to subsistence for three assemblages in the central Ozarks.

Taxon	Living Floor 3MR80-Area D weight %	Midden 3MR80-Area D weight %	Mississippian 3NW205 weight %
Large mammal	85.7	82.6	74.6
Small mammal	1.4	1.1	2.3
Bird	4.2	4.5	3.0
Turtle	8.3	11.2	17.7
Snake	0.1	0.2	0
Amphibian	*	*	0.1
Fish	0.2	0.5	1.4
n =	969/867.6 g	6470/4405.5 g	451/406.3 g

* Data for 3NW205 taken from Scott 1988:200, Table 39.

CHAPTER 9

Cultural Reconstructions for the Premidden Components at 3MR80-Area D

GEORGE SABO III

Introduction

Various lines of evidence summarized in Chapters 6 to 8 concerning the premidden occupations at 3MR80-Area D are brought together in this chapter in an attempt to reconstruct some of the cultural characteristics of the prehistoric people whose activities created this archeological site. In Chapter 10, the same attempt is made for the midden component at the site, for which a much larger body of evidence exists. To acquaint readers who are not archeologists with some of the fundamental nuances of archeological interpretation (and to alert professional colleagues to our theoretical preferences and biases), we will begin with a review of several key concepts guiding the analyses summarized below. Our hope is that we will make clear the logical premises from which our interpretations are derived.

In this and the following chapter, the reconstruction of cultural patterns for each prehistoric component is developed in two parts. First, the basic identification of each component is reiterated in terms of its stratigraphic position within the site, age, artifact assemblage, associated features, and identified faunal and floral remains. Next, inferred cultural characteristics for each component are presented with an emphasis on activity profiles, technological processes, intrasite patterns and community organization, resource procurement activities, and external social relations. It should be noted here that the lithic assemblage from our excavations--much of which came from the Stratum 5 midden deposit--constitutes by far the largest single data set. The lithics data have thus furnished the basis for a variety of interpretations, especially those concerning prehistoric activity profiles and technological processes. For this reason, much of the discussion below centers on the issues concerning the technofunctional assessment of prehistoric lithic assemblages. Related issues concerning the interpretation of archeobotanical and zooarcheological remains have already been addressed in Chapters 7 and 8.

For most of the premidden components, inferred cultural characteristics are necessarily conjectural, and they dwell more on the interpretive potential of the site than on presently established conclusions.

Basic Principles Guiding the Rush Project Artifact Analyses

The reconstruction of activity sets based on artifact assemblages can be undertaken at two levels. At the first and simpler level, the assemblage diversity in terms of individual artifact types can be taken as a general measure of the range of activities (from limited to extensive) represented at an archeological site. Furthermore, consideration of the kinds of artifacts present in the assemblage can furnish additional information about activities that were likely performed with those artifacts. For example, in examining an assemblage of chipped stone artifacts containing arrow points, sharp edged biface tools, scrapers, perforators, celts and adzes, and hammerstones, cores, and flakes, it is a relatively straightforward matter to infer that hunting, butchering, hideworking, heavy woodworking, and stone tool manufacturing activities had produced that assemblage. Thus, a general activity profile for the assemblage can be constructed that can be used to interpret the site and for comparison with other assemblages.

If one were interested in actually documenting the specific uses to which an artifact had been put, however (or, for that matter, whether an artifact had indeed ever been used at all), a more detailed study of microscopic use-wear traces would be needed. The study of use-wear traces on prehistoric stone artifacts is now a reasonably well developed science (e.g., Hayden 1979; Keeley 1980; Vaughan 1985), with standards accepted among practitioners for laboratory preparation of specimens, use-wear attribute discrimination and interpretation, and photomicrographic documentation of exemplar specimens. The analysis of use-wear traces on bone, shell, and ceramic artifacts is less developed, but progress toward a level of sophistication comparable to lithic use-wear analyses is rapidly being made.

For this study, general activity profiles were constructed for each component's artifact assemblage based on an assessment of generic morphological attributes of individual specimens. Though caution must be taken in interpreting the resulting activity profiles, the impressions gained can often be given additional support by examining related data sets, such as, for example, faunal and floral remains preserved at the site to support inferences of hunting and butchering activity, or postmold patterns to support inferences of heavy woodworking. While it would be desirable to bolster conclusions based on functional assessments of artifact assemblages with more detailed use-wear or other specific analyses, such undertakings were beyond the scope of this project.

At some point in the future it would be worthwhile to undertake more detailed analyses of the artifacts from 3MR80-Area D. To date, the only studies of the kind described above that have been completed for sites in the Ozark region are those from the various projects associated with the Rodgers Shelter excavations in Missouri (Ahler 1971; Wood and McMillan 1976; Kay 1982a).

The reconstruction of technological processes involved in the production of stone tools at prehistoric sites is an objective that is readily attainable from the macroscopic examination of adequate sized assemblages. A variety of approaches exist for isolating the "lithic reduction sequence" or "trajectory" represented in an assem-

blage of stone tools, fragments, preforms, cores, flakes, and so forth (e.g., Swanson 1975). Two problems that commonly afflict attempts to apply these models are 1) replicability of the classification criteria used by one investigator to partition an assemblage into lithic reduction sequence "end products" or "product groups," and 2) lack of pertinence of the results of these studies to the consideration of other aspects of prehistoric cultural systems, especially from the perspective of other data sets. In the first problem, the criteria one investigator may employ to discriminate, say, a "blank," from a "preform" or a "preform trimming flake" from a "resharpening flake," are quite often in practice hopelessly idiosyncratic, no matter how elegantly phrased the definitions may be. In the second problem, the results of these studies are, unfortunately, quite often so specific that their relevance to larger issues concerning prehistoric lifeways is not immediately apparent. In the extreme case, reconstructions one flake at a time of how a particular dart point was made may impress the reader only with a profound sense of the tedium of the analysis. This need not be the case, if archeologists' views concerning prehistoric cultural "systems" have any validity, for surely stone tool making and using must have been activities that were integrated to some extent with a variety of other tasks.

These two shortcomings in the application of reduction sequence models to the analysis of lithic assemblages from archeological sites were addressed by Marvin Kay in his study of Late Caddo subtractive technology at the Cedar Grove site and nearby sites in the Red River area of southwest Arkansas (Kay 1984). The model he developed for reconstructing subtractive technologies seems capable of overcoming both problems mentioned above, and so it will be useful to briefly consider the specific elements of his model that provide this advantage.

The problem of replicability of results can be solved if the decisions employed in partitioning a lithic assemblage into the constituent elements of a technological process model are reduced to a single, cohesive set of nonoverlapping or binary oppositions. Kay suggests that for subtractive technologies (that is, technologies involving the systematic removal of mass to produce a desired end product), three opposing dimensions are necessary and sufficient for a basic artifact vocabulary consisting of five terms (Kay 1984:176).

The opposing dimensions are:

Material rejection: material selection (symbolized as $M:\overline{M}$)
No reduction: reduction ($R:\overline{R}$)
No tool use: tool use ($T:\overline{T}$)

These three opposing dimensions of a subtractive technology furnish a logical basis for defining five basic, nonoverlapping terms (or "contrast sets" in Kay's explication):

Debitage (MRT)
Blanks ($\overline{M}$RT)
Preforms ($\overline{M}\overline{R}$T)

Expediency tools ($\bar{M}R\bar{T}$)
Finished tools ($\bar{M}\bar{R}\bar{T}$)

The set of logical relationships, or paradigmatic structures, expressed in this model is illustrated in Figure 9-1. This figure shows that by employing the three opposing dimensions to create five mutually discrete contrast sets, it should be possible to partition a lithic assemblage into unambiguous and replicable artifact categories. Note that the criterion "tool use" is the one by which the category "finished tools" is distinguished. This is the logically appropriate attribute by which a finished piece should be discriminated from a preform or other unfinished piece. But, as argued above, the most effective way to positively identify tool use is via examination of microscopic use-wear traces or other specialized analysis. This underscores the importance of such sophisticated analyses for the advancement of our knowledge of the prehistoric past.

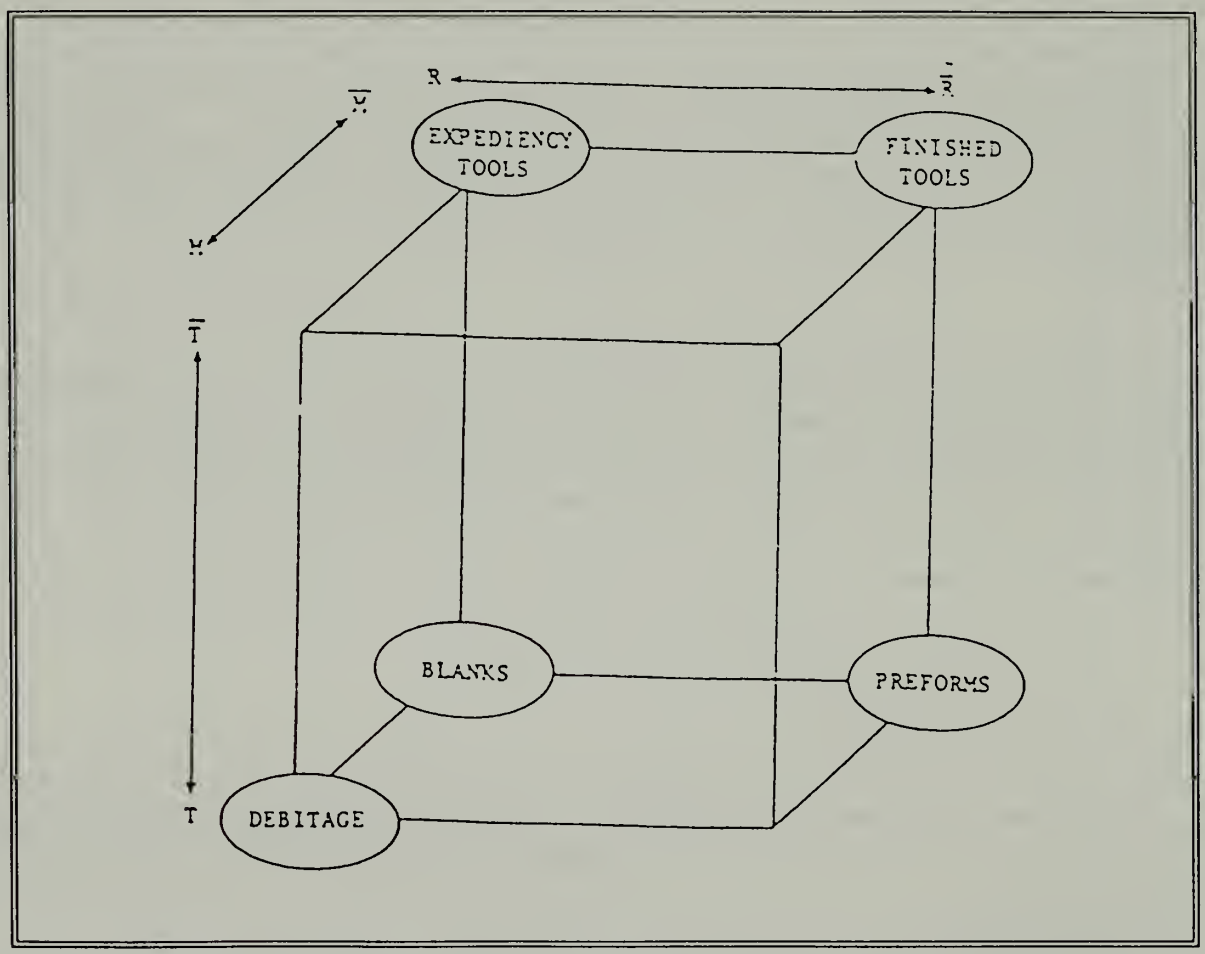


Figure 9-1. Paradigmatic structure of subtractive technology (after Kay 1984).

In the application of Kay's model to the analysis of the 3MR80-Area D lithic assemblage, "finished tools" were identified as any artifact that could be confidently placed in one or more of the morphofunctional categories employed in the DELOS classification. All such artifacts have been worked to an advanced degree, so that with very few exceptions (all in the flake tool categories) they exhibit tertiary flake removal scars and sharp, uniform working edges. Expediency tools included flakes with discernible edge modification (the DELOS category Retouched-Utilized-Modified, or RUM), as well as core tools. Preforms were considered to be any worked piece that could not be confidently placed into at least one of the DELOS functional artifact categories. Such pieces typically exhibited evidence of only primary or secondary flake removal in shaping, and working edges were without the uniformity observed on finished pieces. The debitage category includes all flakes, shatter, cores and core fragments, as well as broken fragments of worked pieces, including preforms and finished tools. For purposes of tabulating artifact assemblages by component, however, fragments that were recognizable as cores, preforms, or a specific category of finished tool, were counted under the more specific classification. In summary, this is a conservative classification in which the category "finished tools" is not artificially inflated.

The second problem area in studies of stone tool production technology--the lack of pertinence of these studies to larger issues of prehistory--is addressed by Kay in the form of a processual model that places technological processes within a larger set of systemic relationships connecting archeological contexts of the present to human ecosystems of the past. This model, illustrated in Figure 9-2, identifies several key elements of

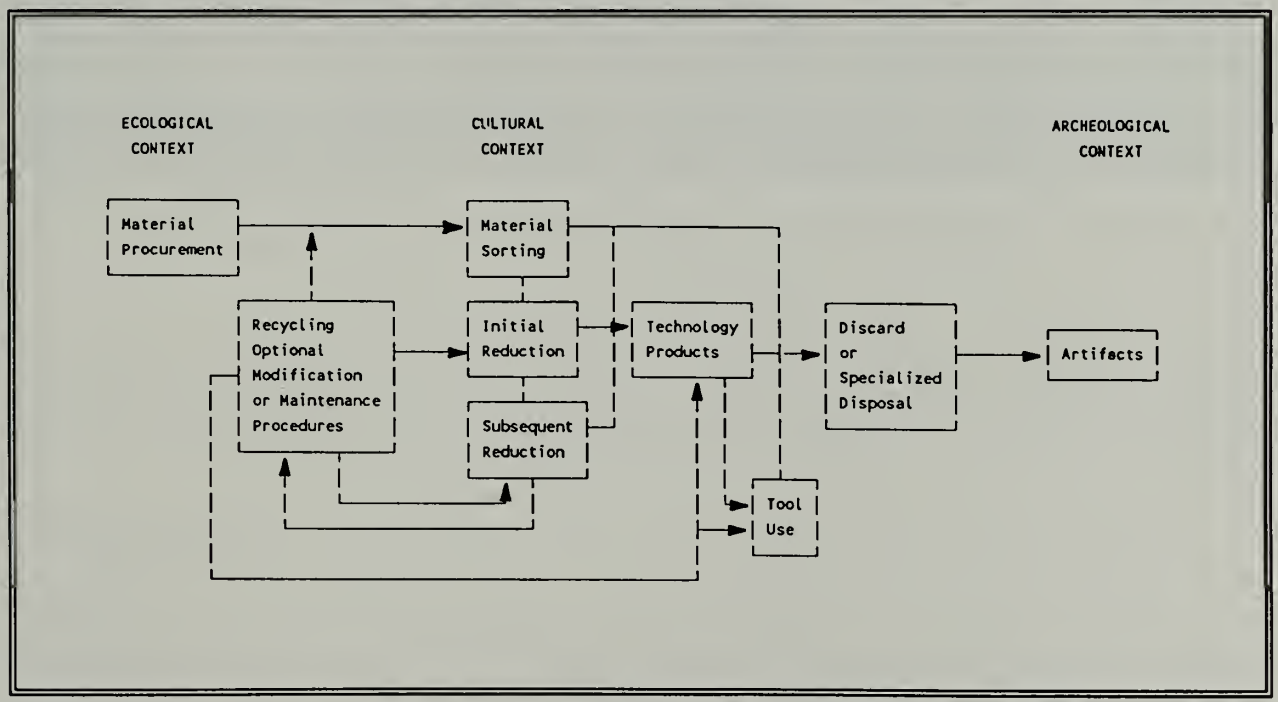


Figure 9-2. General subtractive process model (after Kay 1984).

subtractive technologies and relates them to the appropriate ecological, cultural, and archeological contexts. Inferences concerning the acquisition of raw material for stone toolmaking, for example, can be related to considerations of other environmental resources used by prehistoric people. Such consideration raises a related issue concerning how prehistoric people may have organized and scheduled their activities in relation to their need to acquire several critical resources in environmental contexts located at various distances from their settlements. Were these multiple resource acquisition needs coordinated in any way, and if so, in what order or by what ranking would such coordinating efforts be undertaken? These sorts of questions, which stem from the consideration of the significance of artifacts and technologies within separate but related contexts, underscore the potential of lithics studies to contribute insights that are relevant to a range of larger issues.

The Premidden Components at 3MR80-Area D

The Dalton to Early Archaic Component

A component identified by two Dalton lanceolate points, two Graham Cave Side-Notched points, and a Rice Lobed point was isolated in Stratum 1b, a paleosol that developed on top of basal lag gravels and that occurs at various depths within Area D. These artifacts, along with a broken adze collected from Stratum 1b, are illustrated in Figure 9-3. The Dalton point is the diagnostic artifact of the Dalton period which is radiocarbon dated in the Ozarks to 10,500-9,500 B.P. Graham Cave points occur in Dalton and Early Archaic contexts, and Rice Lobed points are generally found in Early Archaic contexts dating between 9,500 and 8,000 B.P. (Sabo et al. 1988: 41-55). These artifacts and associated cultural materials represent the Late Pleistocene-Early Holocene Transition adaptation type.

The Dalton to Early Archaic occupation of 3MR80-Area D took place at a time when the Buffalo River occupied Paleochannel 2 (see Chapter 5). This paleochannel was the source of the Overbank 1 sediments containing these early artifacts. Paleochannel 2 had already migrated from the edge of the Area D landform to the present T_1 scarp, where the subsequent Paleochannel 1 would be located. The accumulation of Overbank 1 sediments had ceased or slowed sufficiently to permit soil development to commence. As Guccione has noted previously, this may indicate a time of renewed downcutting or a reduction of flood events and/or sediment load in the Buffalo River. At this time, postglacial river systems across the Ozarks and indeed throughout the midsouth were adjusting toward modern regimes. In any case, the distance to the Buffalo River from Area D was much less during this initial occupation of the site than it is today.

This was also a time when the Ozarks experienced other significant changes in the biophysical environment. Deciduous tree species including oak, hickory, and elm were expanding within a formerly spruce dominated forest (Wright 1971; King and Lindsay 1976), providing new food and raw material resources for human inhabitants. Pleistocene megafauna had been replaced by modern animal species, although the distribution of these species may have been somewhat different than at present.

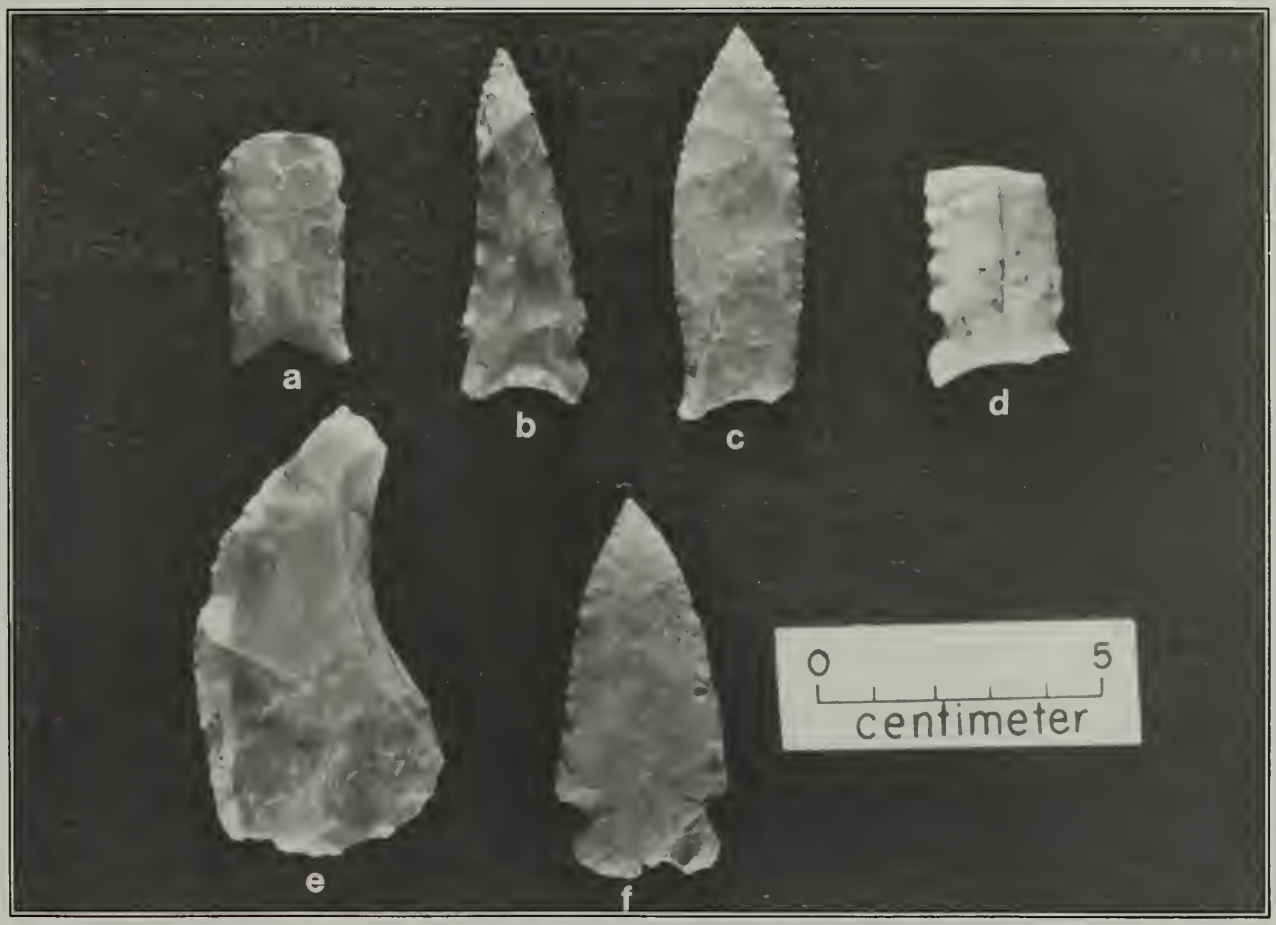


Figure 9-3. Artifacts from Stratum 1b: a = Dalton point; b = Graham Cave point; c = Dalton point; d = Graham Cave point; e = adze; f = Rice Lobed point (AAS Neg. #894508).

Marvin Kay (1982d) has suggested that during early Dalton times, around 10,500 B.P., many western Ozark hillcrests and valley slopes were mantled with loess, thereby restricting human access to certain chert and mineral sources derived from lower member geological strata in the region. The presence of St. Joe and Reeds Spring chert--both lower member derivatives--in the Stratum 1 assemblage from 3MR80-Area D suggests that loess depositions were either not as extensive in the central Ozarks, or else had been eroded prior to this occupation of the site.

A small collection of other chipped stone artifacts was derived from controlled excavations reaching Stratum 1b (Table 9-1). In addition to a small assemblage of flakes, these artifacts include a biface tool, three cores, and the adze. The whole Dalton point and the adze are made of a distinctive green colored chert, of high quality for stone tool making, that occurs locally in the St. Joe limestone formation. As will be seen, this

material was a major resource for stone tool production throughout the entire prehistoric sequence in the Rush locality. The fragmentary Dalton point and the whole Graham Cave point were made of Pitkin chert. The fragmentary Graham Cave point is made of white quartzite, a nonlocal material. The Rice Lobed point was made of locally available Reeds Spring chert. Boone chert is another locally available raw material represented in the artifacts from this component, and one pebble core was found made of chert from a nonlocal Jefferson City dolomite formation (Table 9-2).

Table 9-1. Chipped stone artifacts, Stratum 1b.

Function	N	Percent
Projectile points		
Lanceolate	3	34
Dart	1	11
Maintenance, manufacturing, and processing		
Other biface	1	11
Stone tool production		
Tabular core	1	11
Pebble core	1	11
Unprepared core	1	11
Woodworking		
Adze	1	11
Total	9	100

Table 9-2. Raw material for chipped stone artifacts, Stratum 1b.

	L BOONE	B BOONE	STJOEJ	REEDSB	COTTER	QZIT		
	G BOONE	STJOEG	REEDSG	PITKIN	JEFCIT	UNID	TOTAL	
Lanceolate			1		1	1	3	
Dart				1			1	
Other biface	1						1	
Tabular core				1			1	
Pebble core					1		1	
Unprep core		1					1	
Adze			1				1	
Total	1	1	2	2	1	1	1	9

Two thirds of the Stratum 1b artifacts were heat treated, including the whole Dalton point and the whole Graham Cave point (Table 9-3). Except for two of the cores, none of the worked pieces retains any cortex (Table 9-4).

Table 9-3. Heat treated artifacts, Stratum 1b.

	HT	Not HT	Total
Lanceolate	2	1	3
Dart	1		1
Other biface	1		1
Tabular core		1	1
Pebble core	1		1
Unprepared core		1	1
Adze	1		1
Total	6 (67%)	3 (33%)	9

Table 9-4. Chipped stone artifacts with cortex, Stratum 1b.

	Cortex	No Cortex	Total
Lanceolate		3	3
Dart		1	1
Other biface		1	1
Tabular core	1		1
Pebble core	1		1
Unprepared core		1	1
Adze		1	1
Total	2 (22%)	7 (78%)	9

As discussed in Chapter 6, controlled excavations in only three test units reached Stratum 1b, and of these, only the excavations in N995/E998 produced much in the way of an artifact sample from this stratum. Consequently, the total assemblage representing this component is very small, and there are no associated archeological features. Very little can therefore be determined about the cultural characteristics of the earliest known inhabitants of the Rush site, but a few noteworthy observations can be made on the basis of the evidence in hand.

First, the variety of raw materials represented in this very small artifact collection is surprising (Figure 9-4), especially in view of the fact that three of these materials--the Pitkin and Jefferson City cherts and the

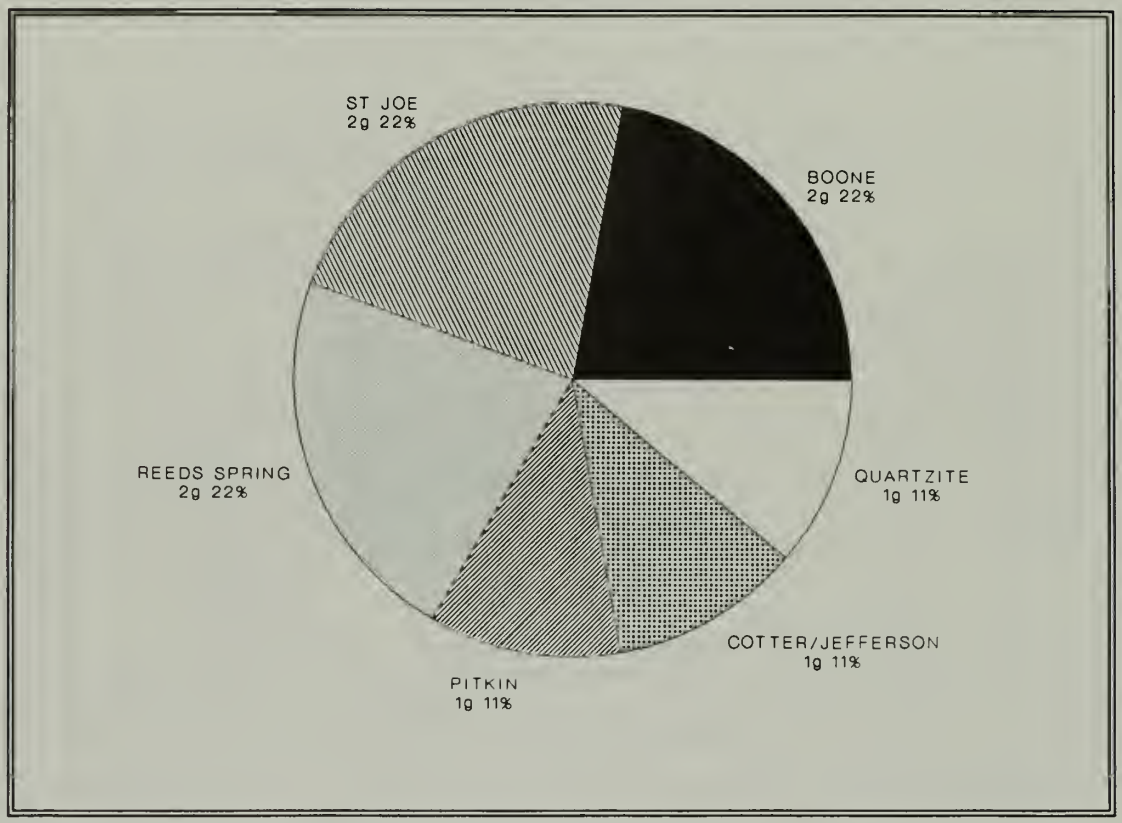


Figure 9-4. Raw material groups for Stratum 1b (chipped lithics).

quartzite--do not occur in the vicinity. As will be mentioned in the GIS analysis presented in Chapter 12 of bedrock sources accessible from the Rush site, Pitkin chert pebbles could have been acquired in detritus concentrations further up the Rush Creek and Clabber Creek valleys, and the bedrock itself occurs as near as 15 km distance. Quartzite does not occur in northern Arkansas (Bob Harris, personal communication), but it does occur along with the Jefferson City dolomites in southern Missouri. This distribution of stone resources utilized by the Dalton period inhabitants of the Rush site implies either travel to those locations or contact with other people living or passing through those places.

Another significant aspect of the artifact assemblage from Stratum 1b is the presence of the adze. This woodworking tool, a common element of the Dalton toolkit in eastern Arkansas, is considered to be an important indicator of post-Pleistocene adaptations to expanding hardwood forests (Morse and Goodyear 1973; Goodyear 1974). Further excavations to more thoroughly sample the Dalton component at 3MR80-Area D would be required to continue investigating the nature of these early adaptations. The potential for such a study certainly seems to be present at this site, however, and additional research could contribute extremely

valuable information concerning the poorly understood Late Pleistocene-Early Holocene Transition adaptation type in the Ozark region.

Early to Middle Archaic Occupations in Stratum 2

Excavations in test units reaching Stratum 2 produced no identifiable artifacts, with the exception of a fragmentary Dalton point collected from the 2a sediment in N998/E995. However, several identifiable Early to Middle Archaic points were collected from this stratum during backhoe trenching operations, suggesting that one or more components could be isolated dating to that era and representing the Early to Middle Holocene adaptation type. The artifact data from Stratum 2 are summarized in Tables 9-5 to 9-8, and Figure 9-5.

Table 9-5. Chipped stone artifacts, Stratum 2.

Function	N	Percent
Projectile points		
Lanceolate	1	03
Dart	8	24
Maintenance, manufacturing, and processing		
Other biface	8	24
Stone tool production		
Preform	4	12
Pebble core	1	03
Unprepared core	7	22
Woodworking		
Celt	1	03
Unmodified raw material		
Chert	3	09
Total	33	100

The Early to Middle Archaic inhabitation postulated for Stratum 2 would have taken place at a time when the Buffalo River occupied Paleochannel 1 near the edge of the present T_1 scarp. Cultural materials reflecting this era of inhabitation are contained in the Overbank 2 sediments deposited on the Area D landform. The uniformity of these sediments suggests stability in the river channel position and in the flood cycle during this era.

Until additional data are obtained from controlled excavation contexts, little can be said about the prehistoric occupations associated with this stratum. It should be mentioned, however, that the Middle Archaic period corresponds to the Hypsithermal climatic interval, when significant environmental changes were affecting local ecosystems across the Ozarks as well as throughout much of eastern North America (Sabo et al. 1988:

48-57). As Guendling points out in Chapter 5, the Stratum 2 sediments at the Rush site contain natural features that may indicate some of the impacts in this locality of mid-Holocene, Hypsithermal events. Thus, 3MR80-Area D holds the potential to extend our understanding of human adaptations to changing environments in the Ozark region.

Table 9-6. Raw material for chipped stone artifacts, Stratum 2.

	L BOONE	B BOONE	STJOEJ	REEDSB	COTTER	QZIT			
	G BOONE	STJOEG	REEDSG	PITKIN	JEFCIT	UNID	TOTAL		
Lanceolate					1			1	
Dart		2	1	2	2		1	8	
Other biface	1		1	3	1	2		8	
Preform	2			1	1			4	
Pebble core	1							1	
Unprep core	1	1	3	2				7	
Celt							1	1	
Total	5	3	4	4	6	1	5	2	30

Table 9-7. Heat treated artifacts, Stratum 2.

	HT	Not HT	Total
Lanceolate		1	1
Dart	1	7	8
Other Biface		8	8
Preform		4	4
Pebble core		1	1
Unprepared core	5	2	7
Celt		1	1
Total	6 (20%)	24 (80%)	30

Table 9-8. Chipped stone artifacts with cortex, Stratum 2.

	Cortex	No Cortex	Total
Lanceolate		1	1
Dart	1	7	8
Other biface		8	8
Preform		4	4
Pebble core		1	1
Unprepared core		2	7
Celt		1	1
Total	6 (20%)	24 (80%)	30

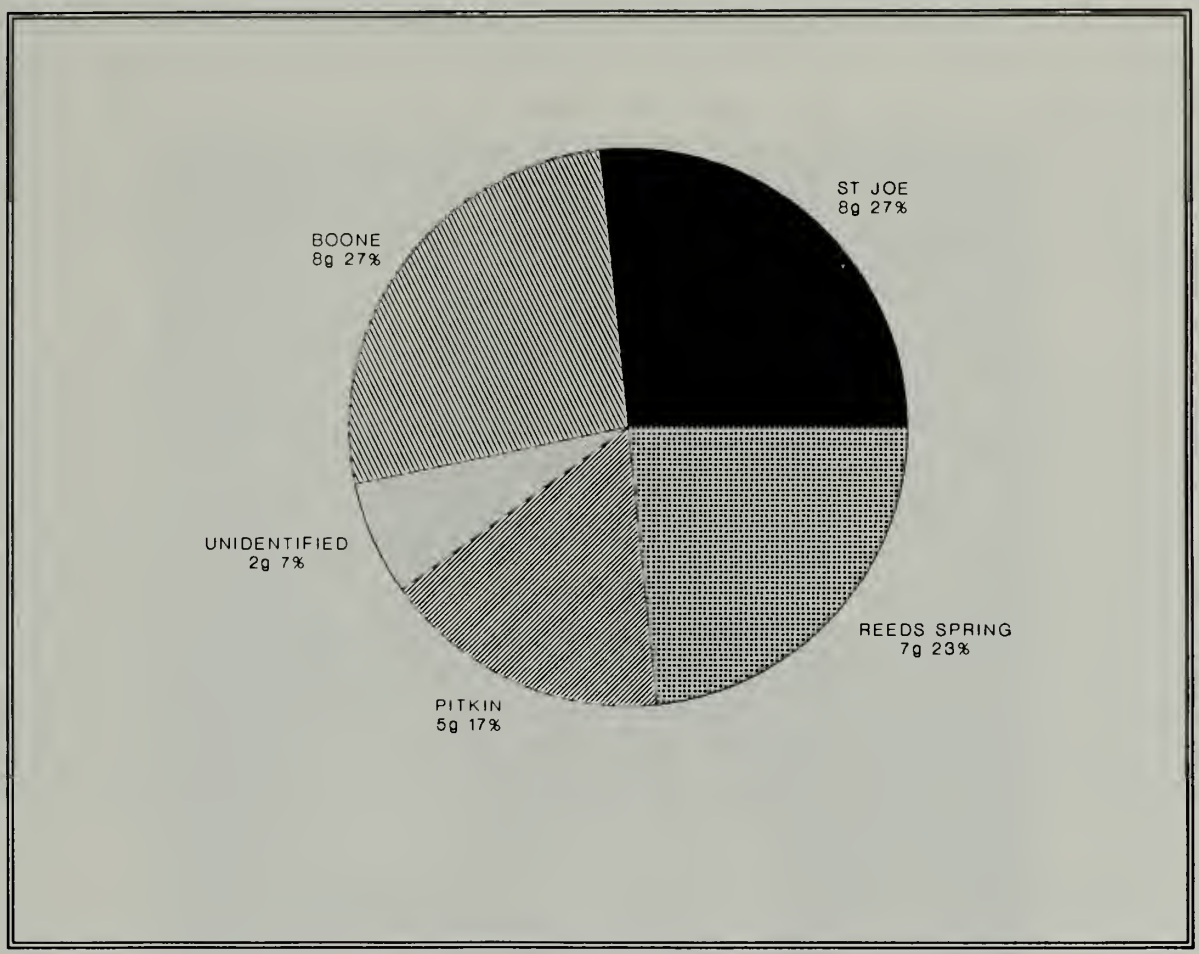


Figure 9-5. Raw material groups for Stratum 2 (chipped lithics).

The Late Archaic Component

As indicated in Chapter 6, Stratum 3 contained several projectile points representing styles commonly found on Late Archaic sites across the Ozarks. Radiocarbon evidence from other sites in the Ozarks suggests that the age of this component would fall in the 5,000-2,500 B.P. interval (Sabo et al. 1988:58).

Stratum 3 is a subunit of the Overbank 1 deposit identified by Guccione within the T_1 terrace (see Chapter 5), so that the Late Archaic materials associated with this stratum represent habitation at a time when the Buffalo River continued to occupy Paleochannel 1. As noted above, this was a period of stability in the hydrological regime and flood cycle.

This period of occupation also corresponds to the end of the Hypsithermal climatic interval. Pollen evidence from a number of locations on the western margins of the Ozarks (Gruger 1973; Albert 1981) com-

bined with geomorphological evidence (Brakenridge 1981) suggests an increase in effective moisture throughout the region. This gave rise to adjustments in forest communities in the direction of modern associations. Vegetation communities in bottomland habitats such as the Rush locality were probably within the range of modern variation. In upland habitats, however, oak openings and prairie areas probably remained somewhat more widespread than in subsequent times. These habitats are preferred by deer and other forest edge species, and consequently human populations in the Ozarks might have enjoyed an expanding food resource base during this era. Stable riverine environments would also have permitted an increase in the harvesting of aquatic resources including fish, mussels, and turtles.

The artifact assemblage representing this component is sufficiently large to permit preliminary assessments to be made of Late Archaic activity profiles and subtractive technologies. A few of the characteristic artifacts are shown on Figure 9-6, and the inventory of finished tools, cores, and unmodified raw material is listed on Table 9-9. In addition to the dart points, finished tools associated with this component include 6 bifaces that probably served as cutting implements, a core tool with a sharp, broadly serrated edge opposite a backed or blunted surface that would have served effectively as a heavy duty cutting or chopping tool, one multiple edged scraper, and a thick bitted engraving tool. These artifacts are typical representatives of the kinds of tools used for butchering, hideworking, boneworking, and associated maintenance tasks. Preforms, cores, a tested pebble, and a sizable flake assemblage are also represented in the Late Archaic collection and, along with the finished tools, provide a basis for the reconstruction presented below of Late Archaic stoneworking technology. In addition to several unworked pebbles and cobbles of chert, four pieces of unworked hematite were collected. Evidence for hematite processing, possibly for use as a color pigment, is seen at several sites in the Ozarks beginning in Middle Archaic times.

A single grinding stone was the only ground stone artifact found in Stratum 3.

The types of raw materials employed in the production of chipped stone artifacts are indicated in Table 9-10, and Figure 9-7 presents a graphic illustration of these figures. Cherts from the St. Joe formation, which occur in very distinctive red and green colors, were used to make almost half of the finished tools in the Late Archaic assemblage. Boone and Reeds Spring cherts are represented in the remainder of the collection, and the absence of nonlocal cherts is noteworthy. About half of the Late Archaic artifacts bear evidence of heat treatment as part of the production process (Table 9-11), but a few artifacts also retain vestiges of cortex on their surfaces (Table 9-12). Evidently, for the Late Archaic inhabitants of the Dirst site, decortication of preforms and finished tools was not always a necessary procedure.

Turning to the flake assemblage (Tables 9-13 to 9-15), several observations can be made. First of all, the distribution of raw material types across the combined flake assemblage (Figure 9-8) is similar to that for finished tools, except that the flake assemblage includes a small amount of Pitkin chert and quartzite. It was not possible to determine if these flakes were introduced secondarily into the Stratum 3 deposits. Even if these flakes were in an *in situ* context, the quantity is small enough to imply that the Late Archaic inhabitants of the site either did not have access to nonlocal stone resources or preferred not to use them.



Figure 9-6. Artifacts from Stratum 3: a = Afton point; b = Castroville point; c = preform; d = scraper; e = burinated point; f = graver (AAS Neg. #894528).

Table 9-9. Chipped stone artifacts, Stratum 3.

Function	N	Percent
Projectile points		
Dart	4	08
Maintenance, manufacturing, and processing		
Other biface	6	12
Side and end scraper	1	02
Graver	1	02
Core tool	2	04
Stone tool production		
Preform	4	08
Pebble core	1	02
Unprepared core	10	21
Tested pebble	1	02
Unmodified raw material		
Chert	15	31
Hematite	4	08
Total	49	100

Table 9-10. Raw material for chipped stone artifacts, Stratum 3.

	L BOONE	B BOONE	STJOEJ	REEDSB	COTTER	QZIT		
	G BOONE	STJOEG	REEDSG	PITKIN	JEFCIT	UNID	TOTAL	
Dart	2	1			1			4
Other biface	2		2	2				6
Side/end scr			1					1
Graver			1					1
Core tool			2					2
Preform			1	1	2			4
Pebble core			1					1
Unprep core	3	1	4		1		1	10
Test pebble	1							1
Total	8	2	10	3	5	1	1	30

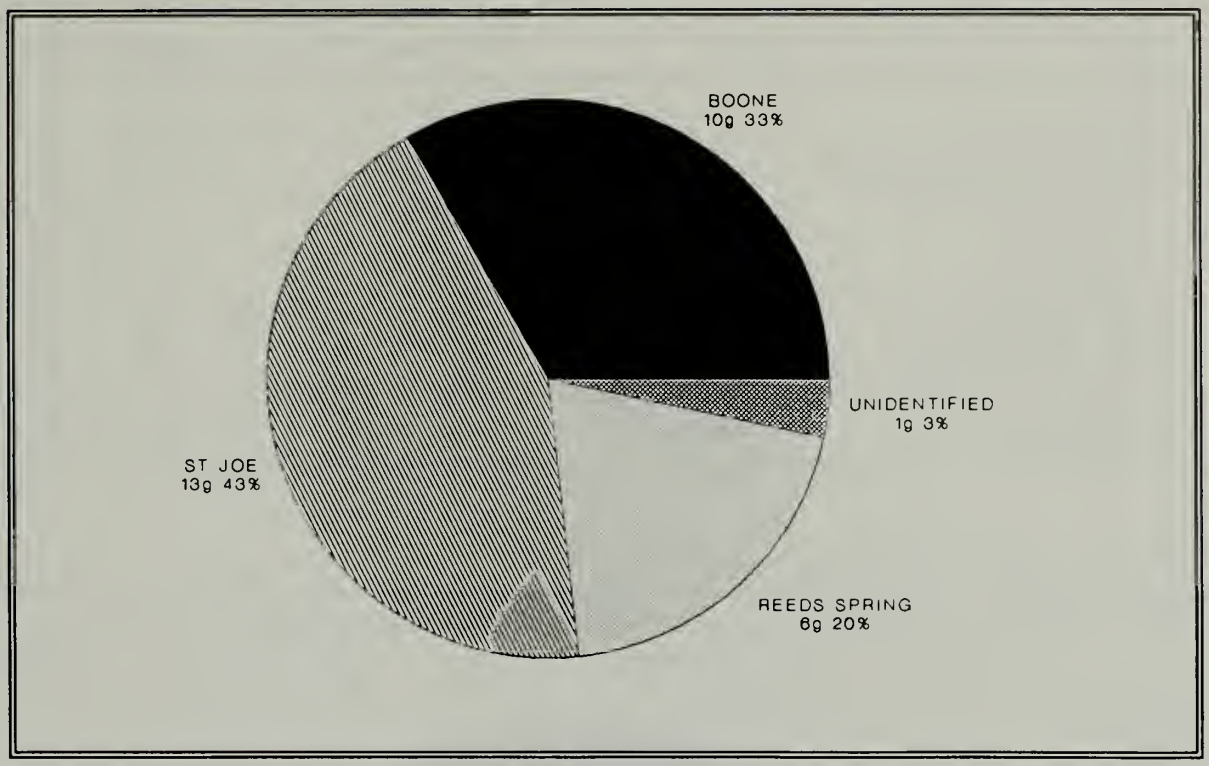


Figure 9-7. Raw material groups for Stratum 3 (chipped lithics).

Table 9-11. Heat treated artifacts, Stratum 3.

	HT	Not HT	Total
Dart	1	3	4
Other Biface	4	2	6
Side and end scraper	1	1	
Graver	1		1
Core tool	1	1	2
Preform	3	1	4
Pebble core	1		1
Unprepared core	3	7	10
Tested pebble		1	1
Total	14 (47%)	16 (53%)	30

Table 9-12. Chipped stone artifacts with cortex, Stratum 3.

	Cortex	No Cortex	Total
Dart		4	4
Other biface		6	6
Side and end scraper	1		1
Graver		1	1
Core tool	2		2
Preform	2	2	4
Pebble core	1		1
Unprepared core	7	3	10
Tested pebble	1		1
Total	14 (47%)	16 (53%)	30

Table 9-13. Weights of unmodified flakes, Stratum 3.

	L BOONE	B BOONE	STJOEJ	REEDSB	COTTER	QZIT			
	G BOONE		STJOEG	REEDSG	PITKIN	JEFCIT		UNID	TOTAL
Size Grade									
5.08									
3.81			15.6					56.8	72.8
2.54	138.2		23.0	34.6	10.7				206.5
1.27	103.3	17.3	154.9	54.4	47.3	11.3	6.5	34.3	429.3
0.64	45.6	32.7	71.3	54.6	13.6	8.5 4.4	1.0	28.8	260.5
Total	287.1	50.0	264.8	143.6	71.6	8.5 15.7	7.5	119.9	968.7

Table 9-14. Weights of modified flakes, Stratum 3.

	L BOONE	B BOONE	STJOEJ	REEDSB	COTTER	QZIT		
	G BOONE	STJOEG	REEDSG	PITKIN	JEFCIT		UNID	TOTAL
Size Grade								
5.08								
3.81								
2.54								
1.27		8.7	23.4					32.1
0.64								
Total		8.7	23.4					32.1

Table 9-15. Weights of shatter, Stratum 3.

	L BOONE G BOONE	B BOONE STJOEG	STJOEJ REEDSG	REEDSB PITKIN	COTTER JEFCIT	QZIT UNID	TOTAL
Size Grade							
5.08							
3.81							
2.54	39.7	18.2	55.7				113.6
1.27	9.4	16.9		2.0		6.6	34.9
0.64	3.6	3.1	1.4 6.3			3.7	18.1
Total	52.7	38.2	1.4 62.0	2.0		10.3	166.6

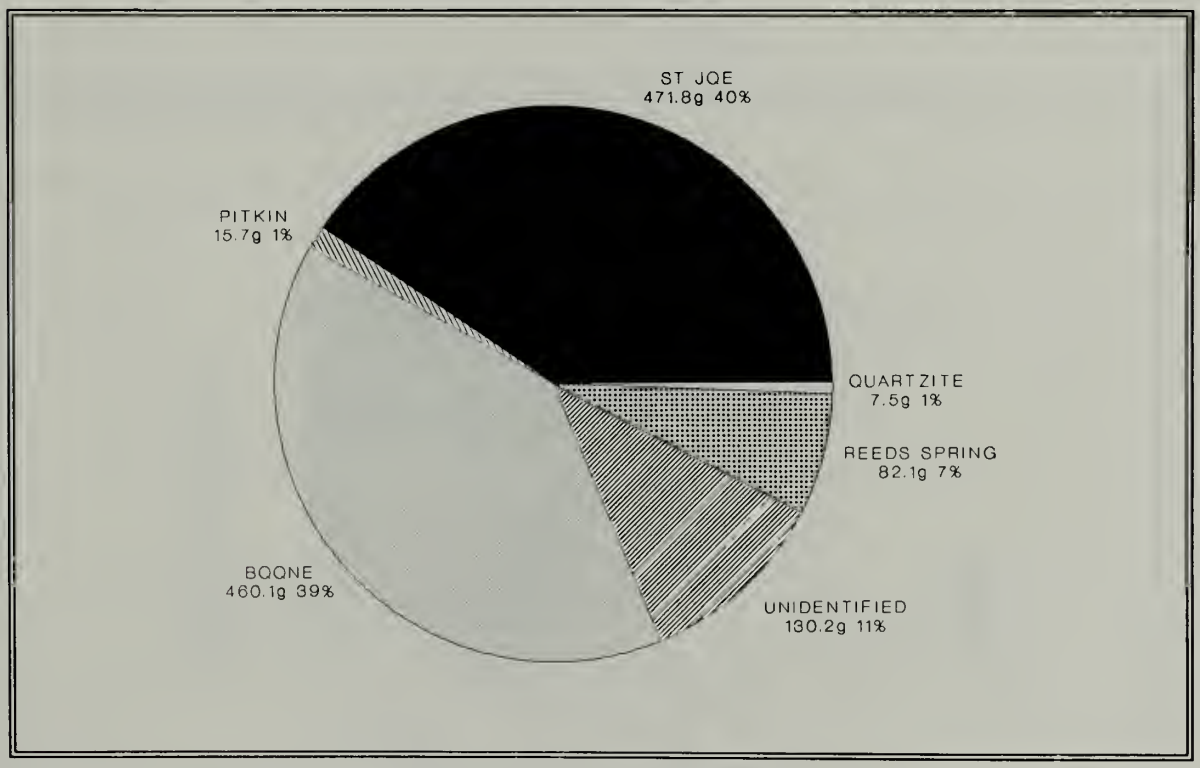


Figure 9-8. Raw material groups for Stratum 3 (combined debitage).

In examining the distribution of raw material types for the individual flake categories (Figures 9-9 and 9-10), it can be seen that the St. Joe cherts were unanimously favored for the few modified flake expediency tools in this assemblage, and, as with the finished tools, these same cherts represent the predominating material. Among the shatter, however, the Boone cherts predominate. This suggests that in comparison to the St. Joe cherts, the Boone cherts were the poorer quality stone, resulting in proportionately more shatter than flakes in the stoneworking detritus. This relationship is also expressed in Figure 9-11, in which a histogram is used to show the relative proportions of flakes and shatter for each raw material group.

An examination of the size grade data for the Late Archaic flake assemblage is also revealing. The pattern represented in the tabulated data can be illustrated on a cumulative percentage graph, as shown in Figure 9-12. This graph shows that generally the chippage in this component is of a relatively small size. The Boone, St. Joe, and Reeds Spring cherts were being employed in stoneworking activities producing a few flakes in the 2.54 cm size grades, but the larger quantity of flakes occur in the 1.27 cm or smaller size grades. In view of the fact that the average sizes of whole tools in the Late Archaic assemblage is larger than the 2.54 cm size grade (Table 9-16), it is possible to interpret these data as indicating that reduction of preforms rather than large chert cobbles was taking place on the site.

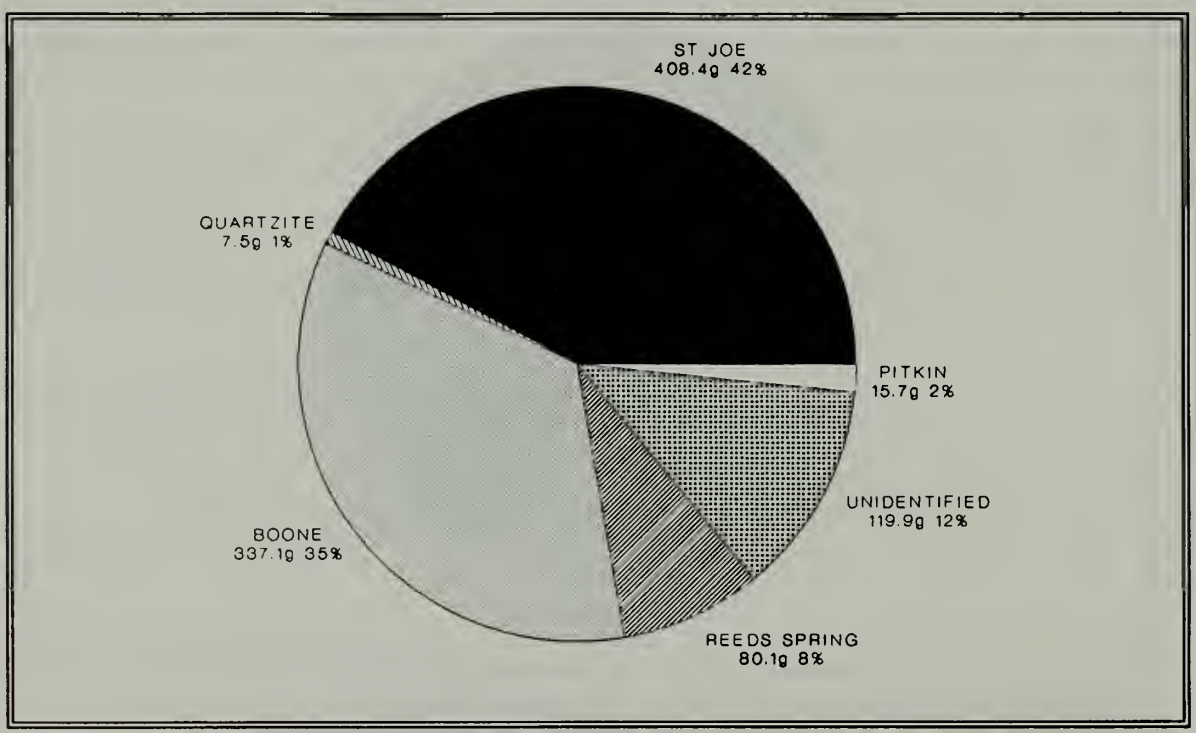


Figure 9-9. Raw material groups for Stratum 3 (unmodified flakes).

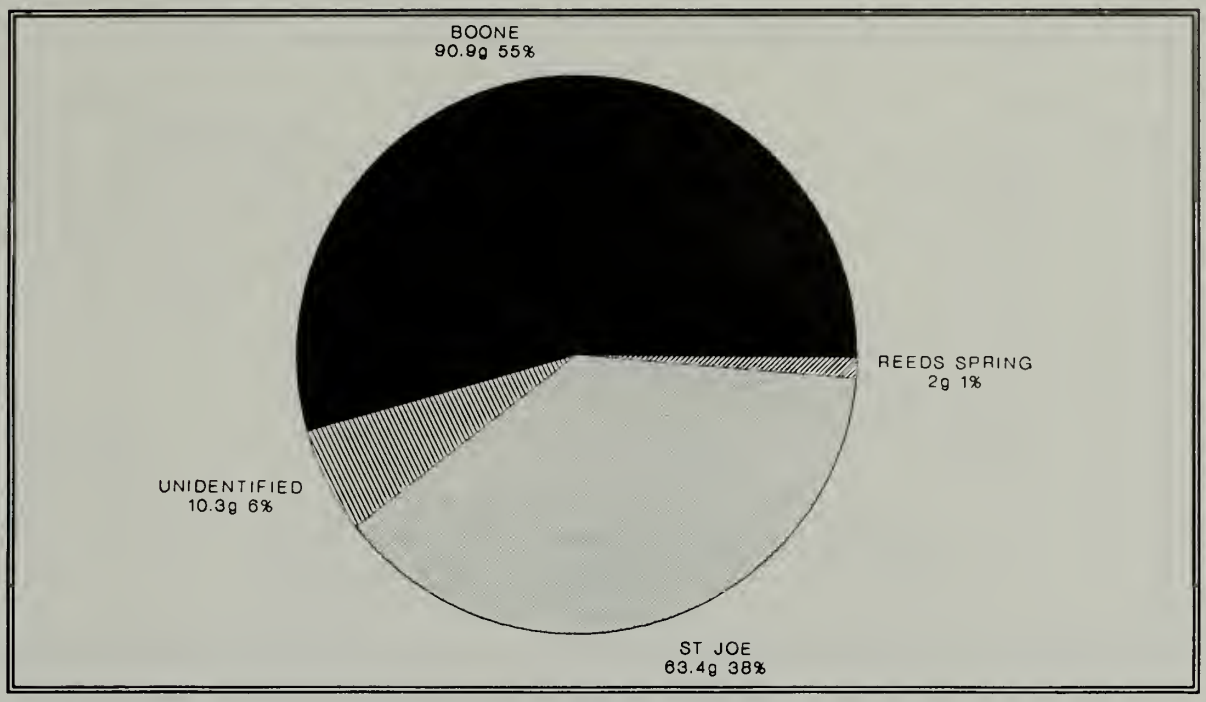


Figure 9-10. Raw material groups for Stratum 3 (shatter).

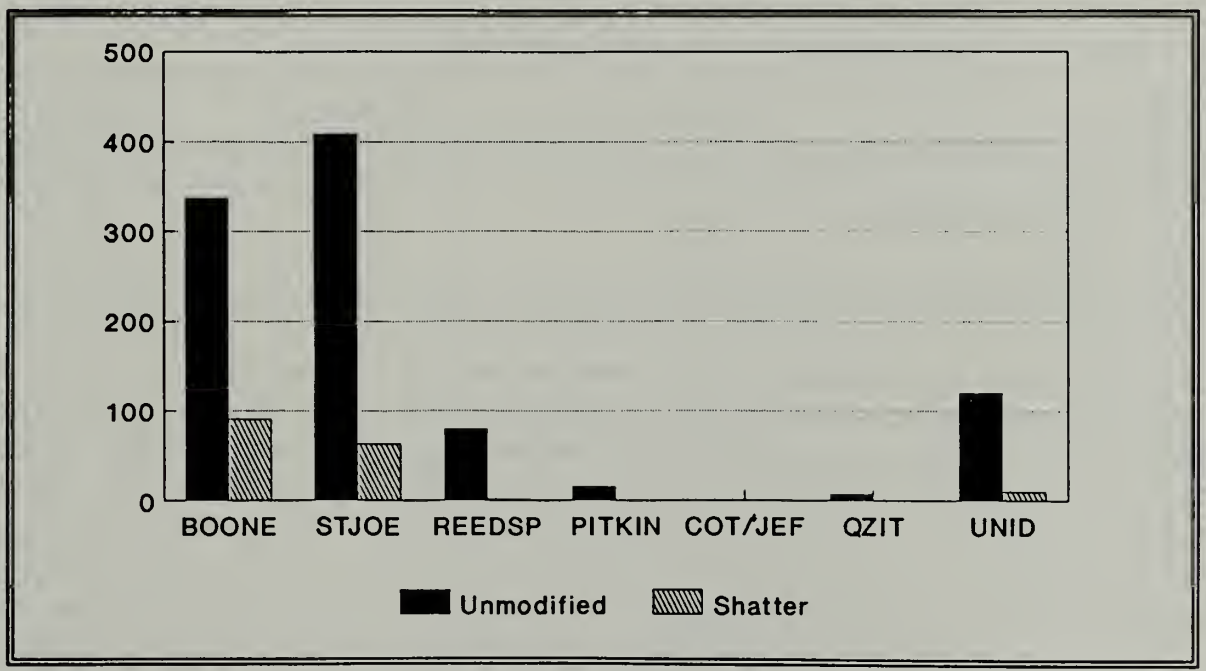


Figure 9-11. Proportions of unmodified flakes and shatter by weight for each raw material type, Stratum 3.

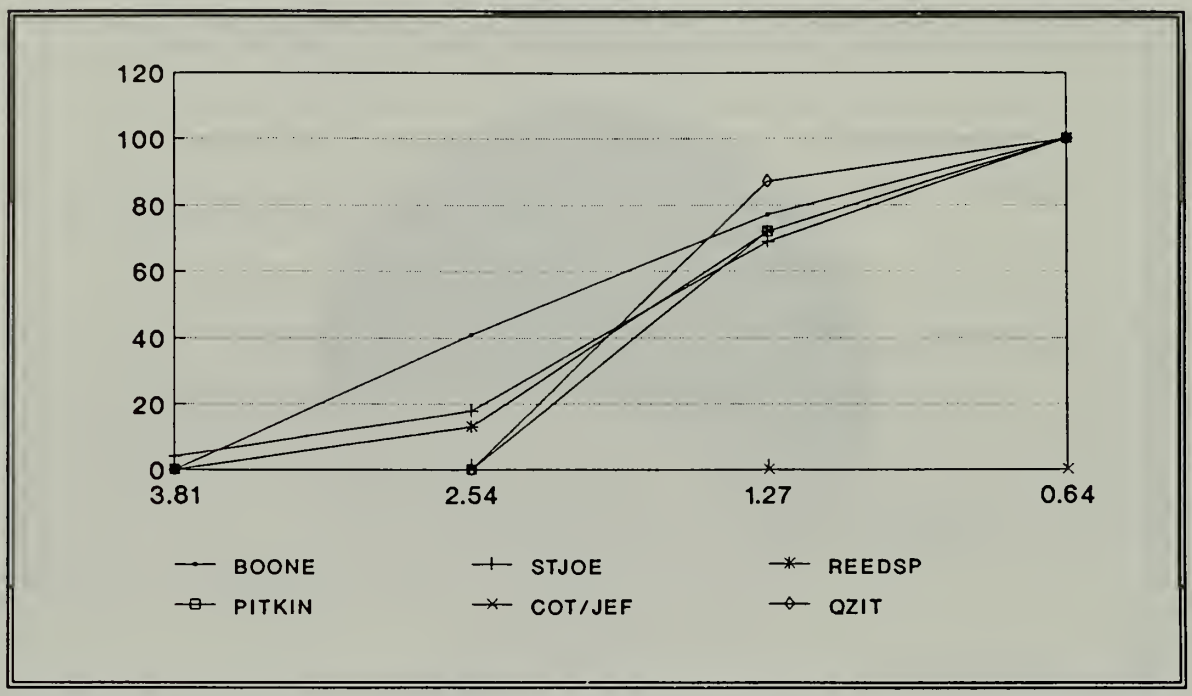


Figure 9-12. Cumulative percentage graph showing distribution by weight of unmodified flake sizes for each raw material type, Stratum 3.

Table 9-16. Chipped stone artifact size ranges (in cm), Stratum 3.

	Minimum	Maximum	Average
Dart	4.89	7.49	6.19
Side and end scraper	6.6	6.6	6.6
Graver	3.24	3.24	3.24
Other preform	6.22	6.22	6.22

Much of the data summarized above can be drawn together in an attempt to reconstruct a model of the subtractive process involved in Late Archaic stoneworking at 3MR80-Area D. This model is illustrated in Figure 9-13. The subtractive process begins with the local gathering of chert pebbles and cobbles, which occur in the vicinity in stream gravel beds and in colluvial accumulations in ravines, along creek valley margins, and in toe-of-slope deposits at the juncture of stream terraces and hillslopes. The single pebble (surely an under-representation) in the assemblage exhibiting an intentional flake removal scar indicates that the gathered raw materials were tested for internal flaws as they were being sorted by size and by raw material type. Indications of heat treatment on several of the cores indicates that thermal alteration was the next step for some of the gathered materials, which improves the tractability of these cherts. Other pieces may have been subjected to heat treatment after initial reduction steps were taken.

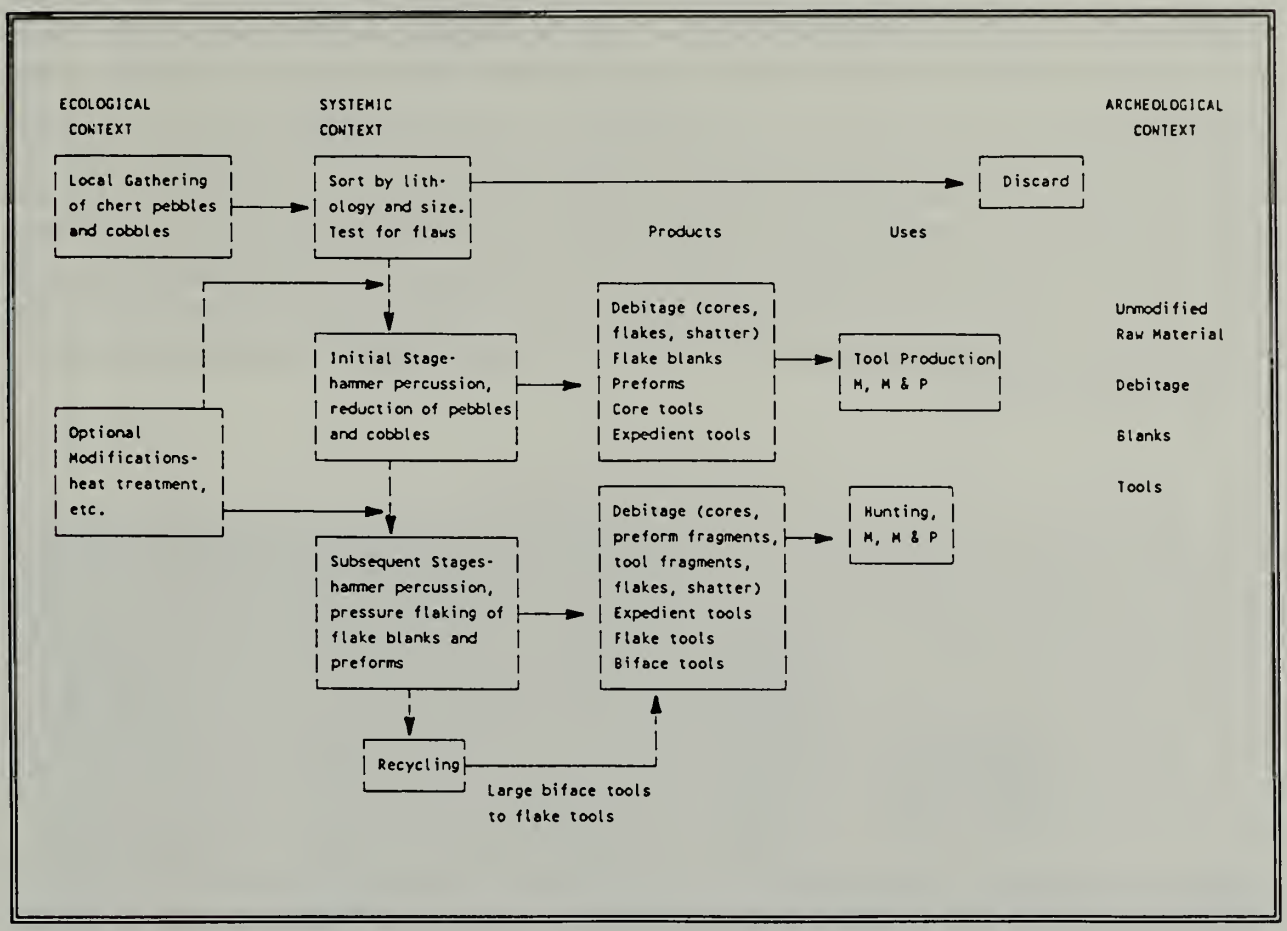


Figure 9-13. Chipped stone production model for the Late Archaic components of 3MR80-Area D.

Initial reduction of pebbles and cobbles seems to have been intended to produce flake blanks suitable only for the manufacture of the smallest tools made of flakes, such as scrapers. The occurrence of edge modified flakes in the assemblage also indicates that some of these flakes were being used as expediency tools for sundry maintenance, manufacturing, or processing activities. The single core tool also would be a product of initial stage reduction. However, what seems to be the case is that the initial reduction of locally gathered cherts was mainly intended to produce preforms for the manufacture of biface cutting tools and hafted projectiles, or darts.

Subsequent reduction of preforms produced a variety of debitage classes, as indicated on the diagram, as well as finished tools and probably additional expedient tools made on some of the larger flake waste. A broken square stemmed dart point or hafted cutting tool that was reworked into a burinated engraving tool indicates that some recycling of pieces was also an element of the technological process.

Turning briefly to the other data sets available for the Late Archaic component, it is necessary to admit that very little can be said. Six flotation samples from Stratum 3 contained preserved floral remains, and the identification of most of these remains as hickory and acorn shell fragments is certainly not surprising, nor is the single chenopod seed found in this component. Faunal remains in this component were too few to warrant comment. General assessments of Late Archaic adaptations in the Ozarks indicate that broad spectrum economies supported small communities of people following a restricted wandering, foraging lifeway (Sabo et al. 1988), and none of the data from the Dirst site contradicts this model. The most significant aspect of this component, though, is its discrete occurrence in a stratified series of deposits that contains evidence of both earlier and later occupations. Thus, further investigations of this component could furnish additional data on Late Archaic lifeways that, when compared with data from the other components at this site, would provide valuable insights concerning cultural continuity and change within the Late Holocene Semi-Sedentary adaptation type in the Ozark region.

Early Woodland Component

A component of Late Archaic or, more likely, Early Woodland age was identified in Stratum 4, which extends from just below the Stratum 5 living floor to the contact with Stratum 3. The sediment in this stratum, representing another subunit of the Overbank 1 deposit on the T_1 terrace, exhibits the anthropic characteristics typical of intensely settled sites. A moderately sized assemblage of artifacts was collected from this stratum: larger than the assemblages from the underlying strata but considerably smaller than the assemblage associated with the long term, intensive occupation of the overlying midden component in Stratum 5. The temporally diagnostic artifacts associated with this component, illustrated along with a selection of other artifact types on Figure 9-14, include a Stone Square Stemmed point, a corner notched Afton point, and a Langtry point. These artifacts, found in stratigraphic association with thick, grog tempered ceramic sherds, suggest an Early Woodland period temporal affiliation which in the Ozarks is thought to date to the 2,500 to 1,850 B.P. interval. The presence of an arc of postmolds well within this stratum represents a highly significant discovery for an Early Woodland component representing the Late Holocene Semi-Sedentary adaptation type. Unfortunately, no other features were encountered.

The Ozark environment of Early Woodland times, as best as can be determined from available evidence, represents a continuation of trends established during Late Archaic times (see above). Ameliorating climatic conditions and general ecological stability would have provided a favorable context for innovative developments among human populations.

The entire assemblage of finished artifacts, cores, and unmodified raw material associated with this component is listed in Table 9-17. The activity profile that may be inferred from this assemblage includes hunting, butchering, hideworking, and associated maintenance, manufacturing, and processing activities. No engraving tools indicative of boneworking were found, although this may simply be the result of incomplete sampling. The presence of two celts and an adze in this component indicates heavy woodworking activity,

including construction of the structure represented by the arc of postmolds. No hematite nodules were identified in this component, but a few pieces of deteriorated limestone may have been brought to the site by Early Woodland inhabitants for use as a white color pigment. The ground stone assemblage is very small, consisting of one pitted stone, one polished stone, and a possible cobble hammer, all made of sandstone.

The sherd assemblage from Stratum 4, though consisting of merely six specimens, is significant with regard to the use of tempering agents during the Early Woodland period (Table 9-18). If the two shell tempered sherds found at the top of this stratum, just below the Stratum 5 living floor, are discounted as intrusions from the overlying component, the remaining sherds are all grog-tempered and are probably representative of the type Williams Plain. This observation may be of some importance in future attempts to isolate Early Woodland components in Ozark archeological contexts.

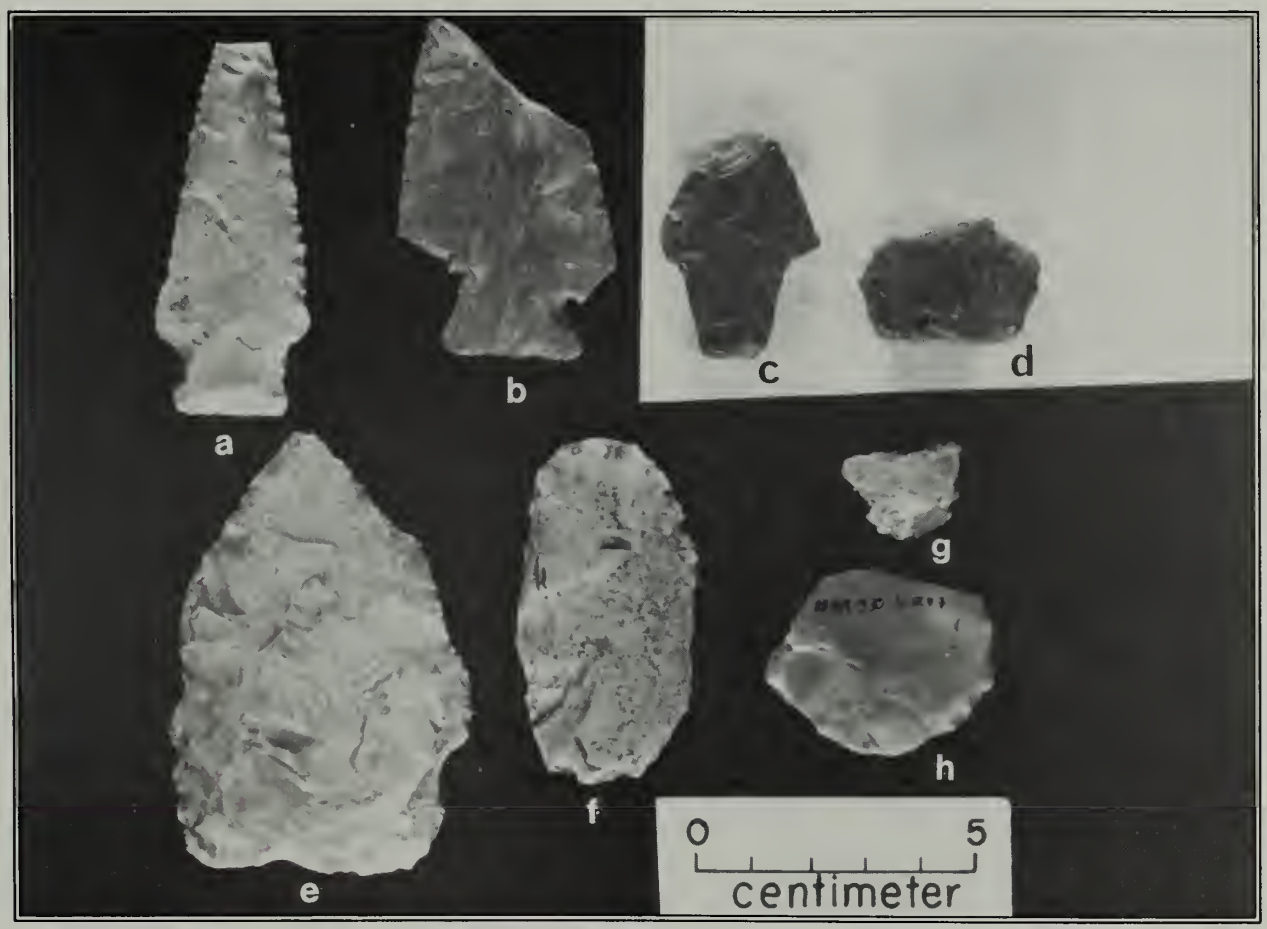


Figure 9-14. Artifacts from Stratum 4: a = Square Stemmed point; b = Afton point; c = Langtry point; d = potsherd; e = preform; f = knife; g = potsherd; h = scraper (AAS Neg. #894512).

Table 9-17. Chipped stone artifacts, Stratum 4.

Function	N	Percent
Projectile points		
Dart	4	10
Maintenance, manufacturing, and processing		
Knife	1	03
Other biface	8	20
Other hafted biface	2	05
End scraper	1	03
Other scraper	1	03
Stone tool production		
Preform	3	08
Tabular core	1	03
Pebble core	5	12
Unprepared core	5	12
Tested pebble	1	03
Tested cobble	1	03
Woodworking		
Axe	1	03
Celt	2	05
Unmodified raw material		
Chert	4	10
Total	40	100

Table 9-18. Ceramics, Stratum 4.

Temper	Sherd Category	N	Percent
Shell	Rim	-	
	Body	2	3
	Base	-	
Grog	Rim	-	
	Body	4	67
	Base	-	
Unclassified sherds (less than 1.24 cm) = 2			

The distribution of raw materials in the chipped stone tool assemblage is summarized in Table 9-19 and illustrated in Figure 9-15. It is interesting that these data suggest a preference among the Early Woodland inhabitants of the Rush site for the Boone cherts, with cherts from the St. Joe and Reeds Spring formation well represented. Moreover, these data indicate the use of artifacts made of Pitkin and Cotter cherts, as well as quartzite and novaculite, all of which implies the acquisition of either finished tools or preforms from sources beyond the Rush locality. Exactly one half of the finished artifacts in the Stratum 4 assemblage were heat treated (Table 9-20), but only one third retained vestiges of cortex on their surfaces (Table 9-21). As was the case in the Late Archaic component, Early Woodland inhabitants at the Rush site evidently did not perceive the removal of cortex from pebble and cobble cherts as a required step in the production of preforms and certain classes of artifacts including hafted cutting tools and scrapers.

Tabulations of flakes and shatter in the debitage assemblage are given in Tables 9-22 to 9-24. The percentages of raw material types for the combined flake assemblage (Figure 9-16) show a slightly greater representation of the St. Joe cherts than the Boone and Reeds Spring cherts. This distribution is consistent for the unmodified flake assemblage (Figure 9-17), but St. Joe cherts are clearly preferred for expedient flake tools. The Reeds Spring and Boone cherts seem also to be contributing disproportionately large amounts of shatter to the assemblage (Figure 9-18). This is undoubtedly a reflection of the poorer quality of these cherts for stone tool manufacture, at least before they are heat treated. Figure 9-19 compares the relative proportions of flakes versus shatter for all of the raw material groups, and the histogram shows, interestingly, that while the use of Boone cherts is producing slightly more shatter than the better quality St. Joe cherts, this use is also producing a large number of flakes. Patterning of the Boone cherts in the debitage assemblage is consistent with the observation that most of the finished artifacts made of those materials had been thermally altered. This would seem to be a necessity given the evident preference of the Early Woodland inhabitants at Rush for tools made of the poorer quality Boone cherts.

Examination of the size grade data for the flake debitage, graphically illustrated in Figure 9-20, shows that only the Boone and St. Joe cherts occur in the 3.81 and 2.54 cm size grades, and even then in relatively small amounts. Most of the flakes occur in the smaller size grades. This may be taken to indicate that reduction of large cobbles was not taking place on the site. Given the average sizes of finished tools in the assemblage (Table 9-25), it appears that preforms for the larger artifacts (such as knives, bifaces, and darts), were being fashioned directly from appropriately sized pebbles. Expectedly, the nonlocal materials are contributing only smaller flake sizes to the assemblage, an observation that is consistent with the assertion that materials of nonlocal origin are being brought to the site in the form of either finished artifacts or preforms.

The combined data sets available for this lithic assemblage can also be used to reconstruct a model of the subtractive processes employed in the manufacture of Early Woodland stone tools at 3MR80-Area D. The resulting model is illustrated in Figure 9-21. The model shows the organization of lithic reduction processes during the Early Woodland period to be essentially the same as during the Late Archaic period, with the one difference being that, during Early Woodland times, the acquisition of nonlocal cherts (including novaculite)

and quartzite in the form of flake blanks and preforms is added. This is not an insignificant change, for it implies either more extensive movement across the landscape on the part of the Early Woodland inhabitants of Rush or acquisition of these materials as part of trade or exchange networks connecting these people to other, more distant communities.

Table 9-19. Raw material for chipped stone artifacts, Stratum 4.

	L BOONE	B BOONE	STJOEJ	REEDSB	COTTER	QZIT	UNID			
	G BOONE	STJOEG	REEDSG	PITKIN	JEFCIT	NOVAC		TOTAL		
Dart		1	1	1	1			4		
Knife	1							1		
Biface	2	1	1	1	2		1	8		
Hafted bi				1		1		2		
End Scr				1				1		
Other scr				1				1		
Preform			1	2				3		
Tab core			1					1		
Pebble core	5							5		
Unprep core	2		2				1	5		
Test pebble	1							1		
Test cobble	1							1		
Axe	1							1		
Celt	1						1	2		
Total	14	1	3	4	7	1	2	1	3	36

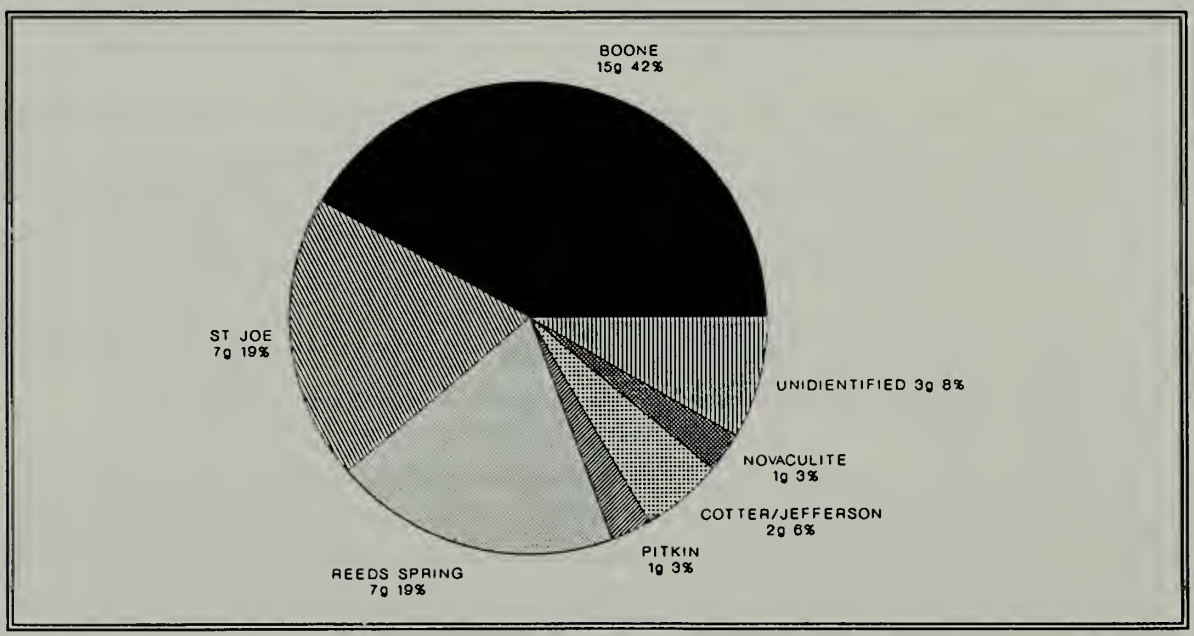


Figure 9-15. Raw material groups for Stratum 4 (chipped lithics).

Table 9-20. Heat treated artifacts, Stratum 4.

	HT	Not HT	Total
Dart	3	1	4
Knife		1	1
Other Biface	7	1	8
Other hafted biface	1	1	2
End scraper	1		1
Other scraper	1		1
Preform	2	1	3
Tabular core		1	1
Pebble core	1	4	5
Unprepared core	1	4	5
Tested pebble		1	1
Tested cobbed		1	1
Axe		1	1
Adze	1	1	2
Total	18 (50%)	18 (50%)	36

Table 9-21. Chipped stone artifacts with cortex, Stratum 4.

	Cortex	No Cortex	Total
Dart		4	4
Knife		1	1
Other biface		8	8
Other hafted biface	1	1	2
End scraper	1		1
Other scraper	1		1
Preform	1	2	3
Tabular core		1	1
Pebble core	5		5
Unprepared core	1	4	5
Tested pebble	1		1
Tested cobble	1		1
Axe		1	1
Celt		2	2
Total	12 (33%)	24 (67%)	36

Table 9-22. Weights of unmodified flakes, Stratum 4.

	L BOONE	B BOONE	STJOEJ	REEDSB	COTTER	QZIT				
	G BOONE	STJOEG	REEDSG	PITKIN	JEFCIT	UNID	TOTAL			
Size Grade										
5.08										
3.81	24.0		13.5					37.5		
2.54	52.0							52.0		
1.27	127.3	32.5	111.3	77.2	82.1	4.2	3.2	51.7	489.6	
0.64	47.4	32.9	92.9	38.4	23.6	5.7	2.4	1.6	26.9	271.8
Total	250.7	65.4	204.2	129.1	105.7	9.9	2.4	4.9	78.6	850.9

Table 9-23. Weights of modified flakes, Stratum 4.

	L BOONE	B BOONE	STJOEJ	REEDSB	COTTER	QZIT		
	G BOONE	STJOEG	REEDSG	PITKIN	JEFCIT	UNID	TOTAL	
Size Grade								
5.08								
3.81								
2.54			11.5	40.9				52.4
1.27	2.3	7.4		7.9				17.6
0.64								
Total	2.3	7.4	11.5	48.8				70.0

Table 9-24. Weights of shatter, Stratum 4.

	L BOONE	B BOONE	STJOEJ	REEDSB	COTTER	QZIT		
	G BOONE	STJOEG	REEDSG	PITKIN	JEFCIT	UNID	TOTAL	
Size Grade								
5.08								
3.81								
2.54								
1.27	5.2		5.4	16.9			6.2	33.7
0.64	8.6	2.7				1.5	2.2	15.0
Total	13.4	2.7	5.4	16.9		1.5	8.4	48.7

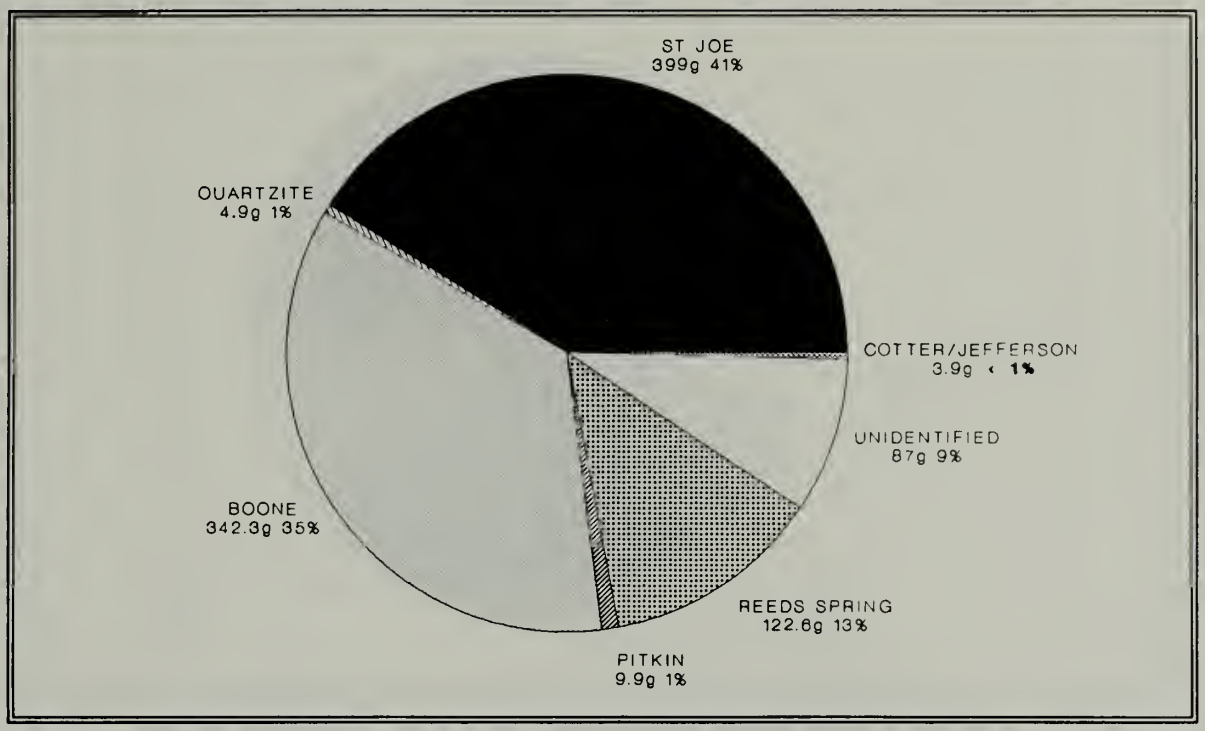


Figure 9-16. Raw material groups for Stratum 4 (combined debitage).

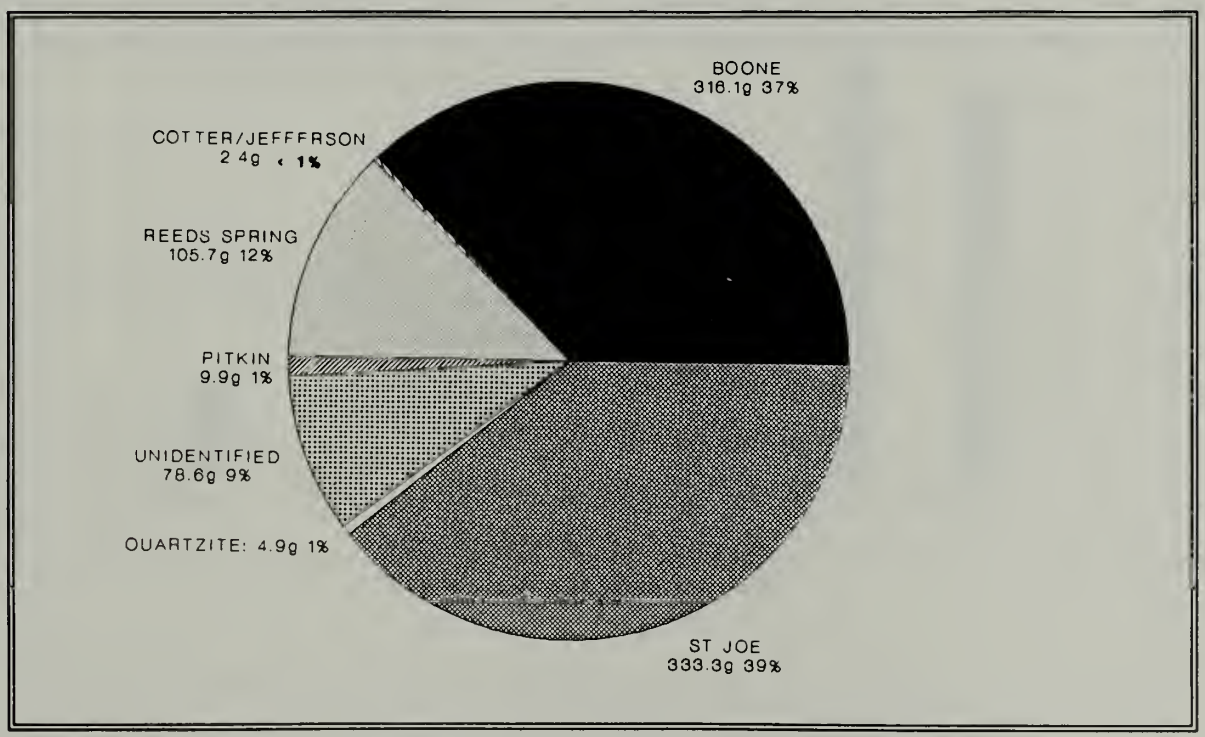


Figure 9-17. Raw material groups for Stratum 4 (unmodified flakes).

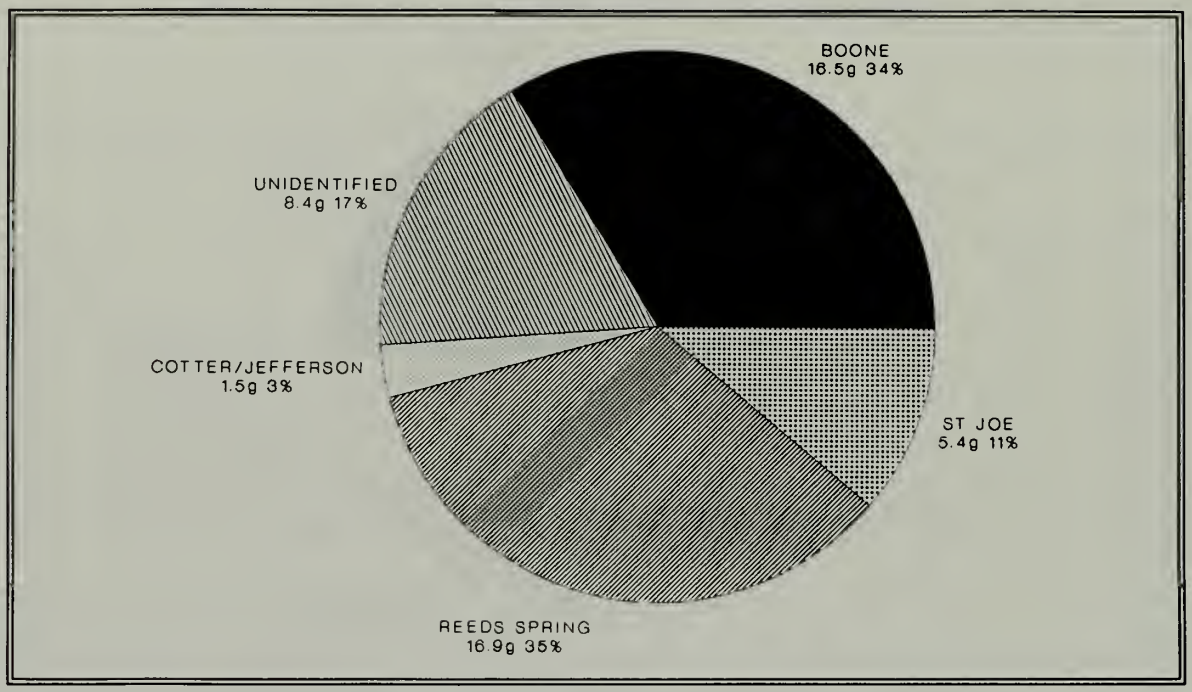


Figure 9-18. Raw material groups for Stratum 4 (shatter).

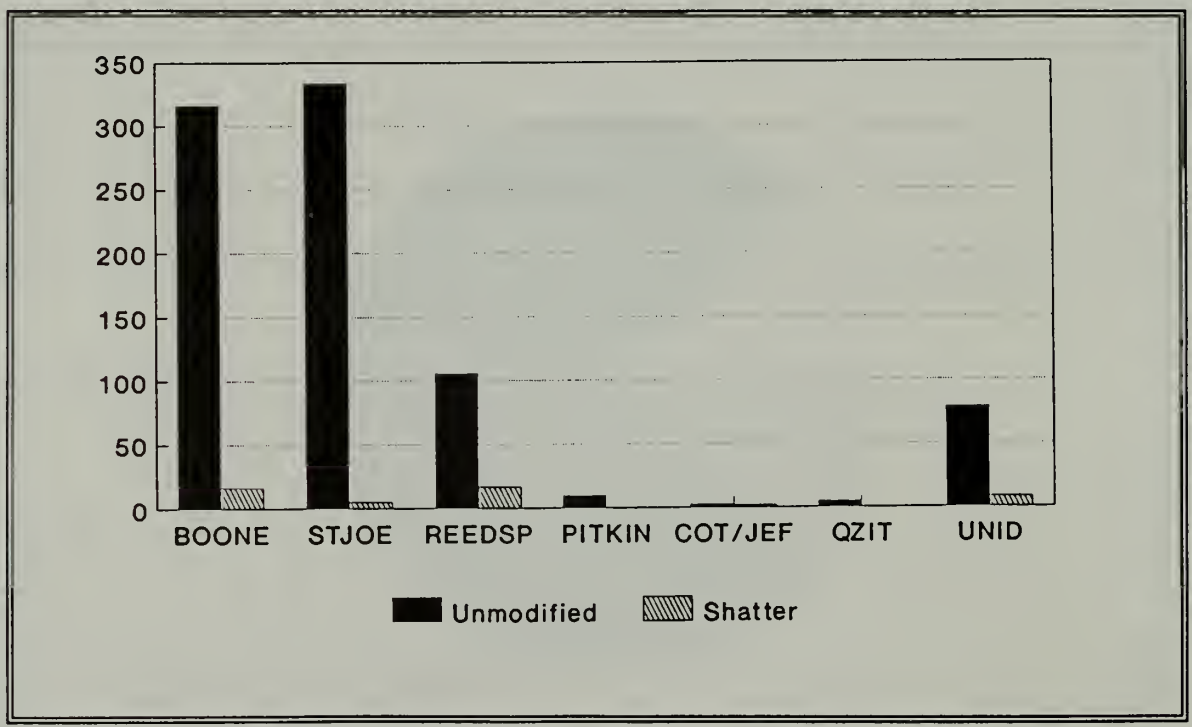


Figure 9-19. Proportions of unmodified flakes and shatter by weight for each raw material type, Stratum 4.

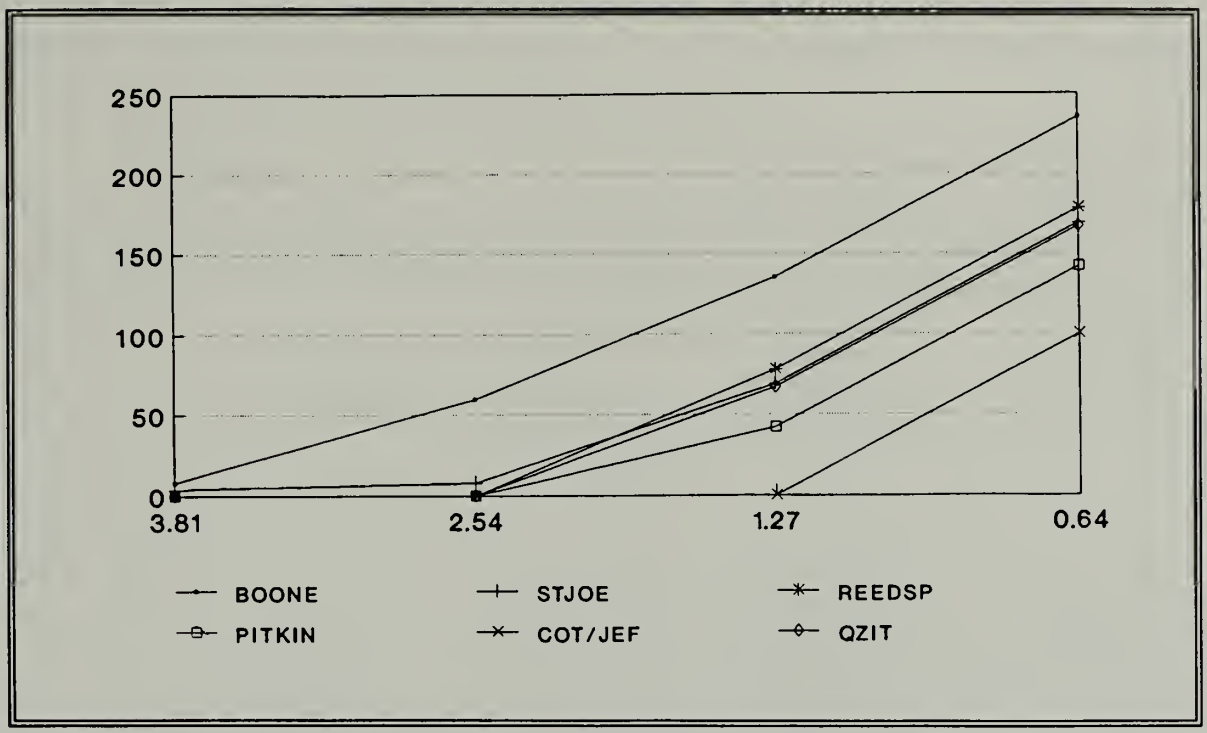


Figure 9-20. Cumulative percentage graph showing distribution by weight of unmodified flakes for each raw material type, Stratum 4.

Table 9-25. Chipped stone artifact size ranges (in cm), Stratum 4.

	Minimum	Maximum	Average
Knife	6.18	6.18	6.18
Other hafted biface	8.00	8.00	8.00
End scraper	5.06	5.06	5.06
Other scraper	4.10	4.10	4.10
Celt	11.27	11.27	11.27

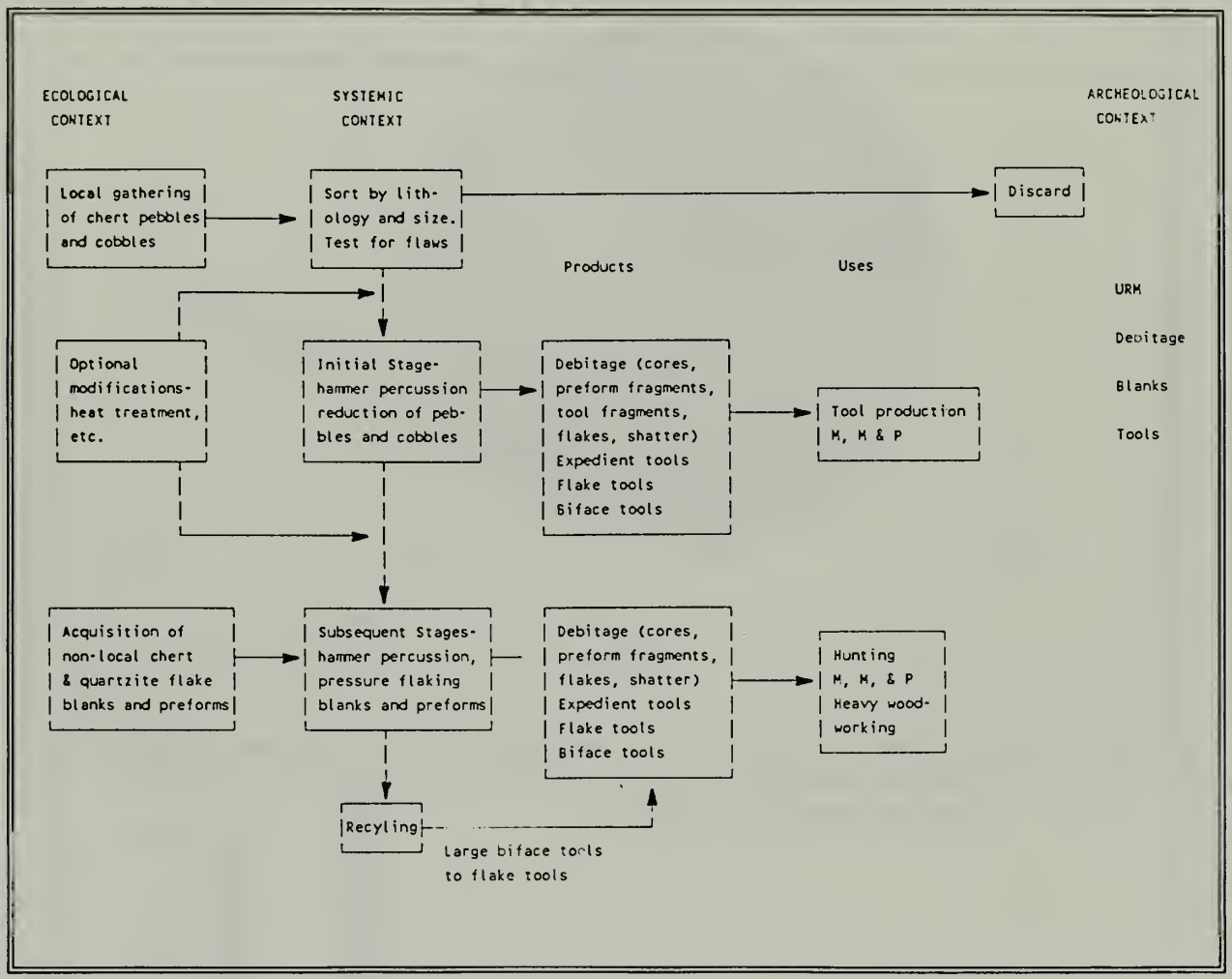


Figure 9-21. Chipped stone tool production model for the Early Woodland component of 3MR80-Area D.

The preceding summary exhausts most of the interpretive potential of the data from the Early Woodland component at 3MR80-Area D. The occurrence of hickory and acorn shells in the few flotation samples collected from Stratum 4 sediments is not surprising, but the identification of knotweed, bedstraw, chenopod, and amaranth seed (in very small numbers) in these samples is intriguing. If the presence of these seeds in Stratum 4 is not merely the result of displacement from Stratum 5, their occurrence suggests that the harvesting of adventitious seed bearing plants may have been in place within the subsistence economies of these Ozark populations by Early Woodland times. One implication of this scenario is that the Early Woodland inhabitants of the Rush locality were living in places like the Dirst site for long enough periods of time to produce the disturbed soil habitats preferred by adventitious plant species. The presence of the arc of postmolds in this component, indicating some degree of permanence to their habitation, is consistent with this scenario.

Animal bone preservation within Stratum 4 was poor, but the few remains that could be identified are consistent with present interpretations that hunting continued during this era as an important element of a broad spectrum subsistence economy (Sabo et al. 1988:57-64). It will be interesting to see if the shift evidenced at the Dirst site toward an increased utilization of plant foods during Early Woodland times had any commensurate effect on the organization or scheduling of hunting activities.

At present, it is not possible to assess the duration or seasonality of the Early Woodland occupation at the Dirst site. It is clear, however, that an important shift toward increasing sedentariness was underway. This is a significant development which when better understood might permit us to reconstruct at least some of the processes involved in the transitions from mobile to semisedentary to sedentary adaptation types in the central Ozark region.

Cultural Reconstruction of the Stratum 5 Midden Component at 3MR80-Area D

GEORGE SABO III

The final prehistoric component at 3MR80-Area D occurs in Stratum 5, the thick Middle Woodland to Early Mississippian midden deposit that extends for a depth of 30-50 cm from the base of recent flood sands that now blanket the landform. Stratum 5 represents the uppermost subunit of the Overbank 1 deposit on the T_1 terrace. The component in this stratum consists of a compacted, rock strewn surface referred to as the "living floor," and the overlying midden. As we noted in Chapter 6, the midden exhibits some internal stratification, and three cultural features were identified in the midden at levels above the living floor. These observations imply that the midden developed over some considerable period of time. This is supported by the radiocarbon evidence: two dates falling into the Middle Woodland period were associated with the filling of a large pit originating at the living floor, and a third assay on charcoal associated with a possible collapsed house higher in the midden provided an Early Mississippian date.

Further support for this interpretation of temporal duration for the midden component is provided by the associated artifact and faunal remains. Artifacts from the living floor were encountered in about the same frequency as they were in the midden, when adjustment is made for the volume of sediments excavated for each context. However, the faunal remains associated with the living floor were far fewer than in the midden and in a significantly more deteriorated condition. This is consistent with the attribution of a greater age for the living floor, as well as subsequent disturbance of that surface by later site inhabitants. It is not possible at the present to determine whether the midden component represents a single, ongoing series of occupations or intermittent habitation at different times within the Middle Woodland to Early Mississippian era. In either case, the cultural materials from this component can be attributed primarily to the Middle to Late Woodland period and represent a manifestation of the Late Holocene Sedentary adaptation type.

Environmental conditions in the Ozarks at the time of the Stratum 5 occupation were generally stable. Plant and animal communities and their characteristic habitat associations of historic times had been established by the Middle Woodland period. A reduction in prairies and oak openings during this era, however, may have led to shifts in the distribution of deer and other forest edge species which consequently may have affected the organization and scheduling of late prehistoric hunting patterns. Additionally, toward the end of the Late Woodland period, about 1,100 years ago, shifts in upper atmosphere circulation patterns brought drier summer conditions to the central plains and western Ozark Highlands. The effects of these

changes further within the Ozark interior probably were modified by the upland character of the region, but a decline in effective soil moisture levels may have been experienced nonetheless. These conditions would have imposed additional stresses upon populations dependent, even partially, upon cultivated plant foods.

A large assemblage of artifacts was retrieved from the midden component (Tables 10-1 and 10-2). The diagnostic projectile points for this component, as discussed in Chapter 6, consist of Scallorn, Agee A, and Pocola arrow points (Figure 10-1), and Rice Side Notched dart points (Figure 10-2). Gary *var. Gary* and Gary *var. Le Flore* dart points were found in lesser numbers, as were Langtry points (Figure 10-3). This assemblage of arrow and dart point types is consistent for a Middle to Late Woodland temporal placement in the Ozark region (Sabo et al. 1988:67-73). Several Archaic point types were also found in the midden component. These are best interpreted as representing displacement from earlier occupation levels that would occur as a result of the kinds of ground disturbing activities that can be attributed to the midden occupation (e.g., Morse and Morse 1980:13).

Other finished tools in the assemblage reflect a broad activity profile for this component. Knives and other biface cutting tools are represented by several specimens exhibiting a variety of blade configurations (Figure 10-4). It is reasonable to suppose that these different implements were made to serve a variety of specific maintenance, manufacturing, and processing needs. A similarly diverse assemblage of scrapers, drills and other perforating implements, and engraving tools (Figure 10-5) are suggestive of extensive hideworking and boneworking activity, as well as related maintenance and processing tasks. Several adzes found in this component, along with one celt and one axe (Figure 10-6), are a legacy of extensive woodworking activity.

Several artifacts reflect stoneworking and the manufacture of chipped stone artifacts at the site. A large number of cores was collected, and among the core assemblage four distinctive types can be recognized (Figure 10-7). Tabular cores exhibit the removal of flakes from opposite sides of flat, generally rectanguloid pebbles of chert. Pebble cores are simply chert gravels from which three or more flakes have been removed. Gravels with only one or two flake scars were classified as tested pebbles (less than 5.08 cm size grade) or tested cobbles (greater than 5.08 cm size grade). The third core type is a shaped variety from which flakes were removed from the margins of a broad, flat striking platform, resulting in a turtleshell shaped discard. The final category of cores consists of unprepared specimens in which the random removal of flakes from multiple directions resulted in an assortment of differently shaped discards and fragments. In addition to these four core types, a fifth category, core tools, is represented in the collection. These are all relatively large specimens (Figure 10-8) prepared in such a way that a broad, sharp cutting edge is produced opposite a thick, blunted margin. These core tools would have served effectively as heavy duty cutting or chopping implements.

Preforms representing both initial and advanced stages of reduction are present in the assemblage. Initial preforms (Figure 10-9) are all large and rectanguloid to ovoid in shape, and exhibit mostly primary flake removal scars. Advanced preforms were classified as either dart preforms or arrow preforms, depending upon their size (Figure 10-10). It is possible that some of the specimens classified as dart preforms were intended for reduction into other tool forms, such as knives or other bifaces. Finally, three battered chert hammerstones are included in this assemblage.

Table 10-1. Chipped stone artifacts, Stratum 5 (midden).

Function	N	Percent
Projectile points		
Arrow	44	07
Dart	83	13
Maintenance, manufacturing, and processing		
Knife	3	*
Other biface	142	23
Other hafted biface	3	*
End scraper	6	01
Side scraper	1	*
Side and end scraper	1	*
Thumbnail scraper	1	*
Spokeshave	2	*
Denticulate scraper	1	*
Drill	1	*
Drill/Awl	1	*
Perforator/graver	1	*
Graver	2	*
Blade	14	02
Core tool	3	01
Stone tool production		
Arrow preform	10	02
Dart preform	6	01
Other preform	96	15
Tabular core	9	01
Pebble core	41	07
Shaped core	6	01
Unprepared core	72	14
Tested pebble	9	01
Tested cobble	4	01
Burin spall	7	01
Hammer	2	*
Woodworking		
Adze	11	02
Axe	1	*
Celt	1	*
Unmodified raw material		
Chert	41	07
Hematite	2	*
Stalagmite/stalagtite	1	*
Calcite crystal	1	*
Quartz crystal	present	
Total	629	100

* = less than .01

Table 10-2. Chipped stone artifacts, Stratum 5 (living floor).

Function	N	Percent
Projectile points		
Arrow	3	03
Dart	4	04
Maintenance, manufacturing, and processing		
Knife	1	01
Other biface	9	09
Other hafted biface	3	03
End scraper	1	01
Side scraper	3	03
Blade	1	01
Core tool	2	02
Stone tool production		
Dart preform	1	01
Other preform	13	14
Tabular core	1	01
Pebble core	3	03
Unprepared core	15	16
Tested pebble	5	05
Tested cobble	2	02
Hammer	1	01
Woodworking		
Adze	2	02
Unmodified raw material		
Chert	25	26
Quartzite	1	01
Hematite	1	01
Total	97	100

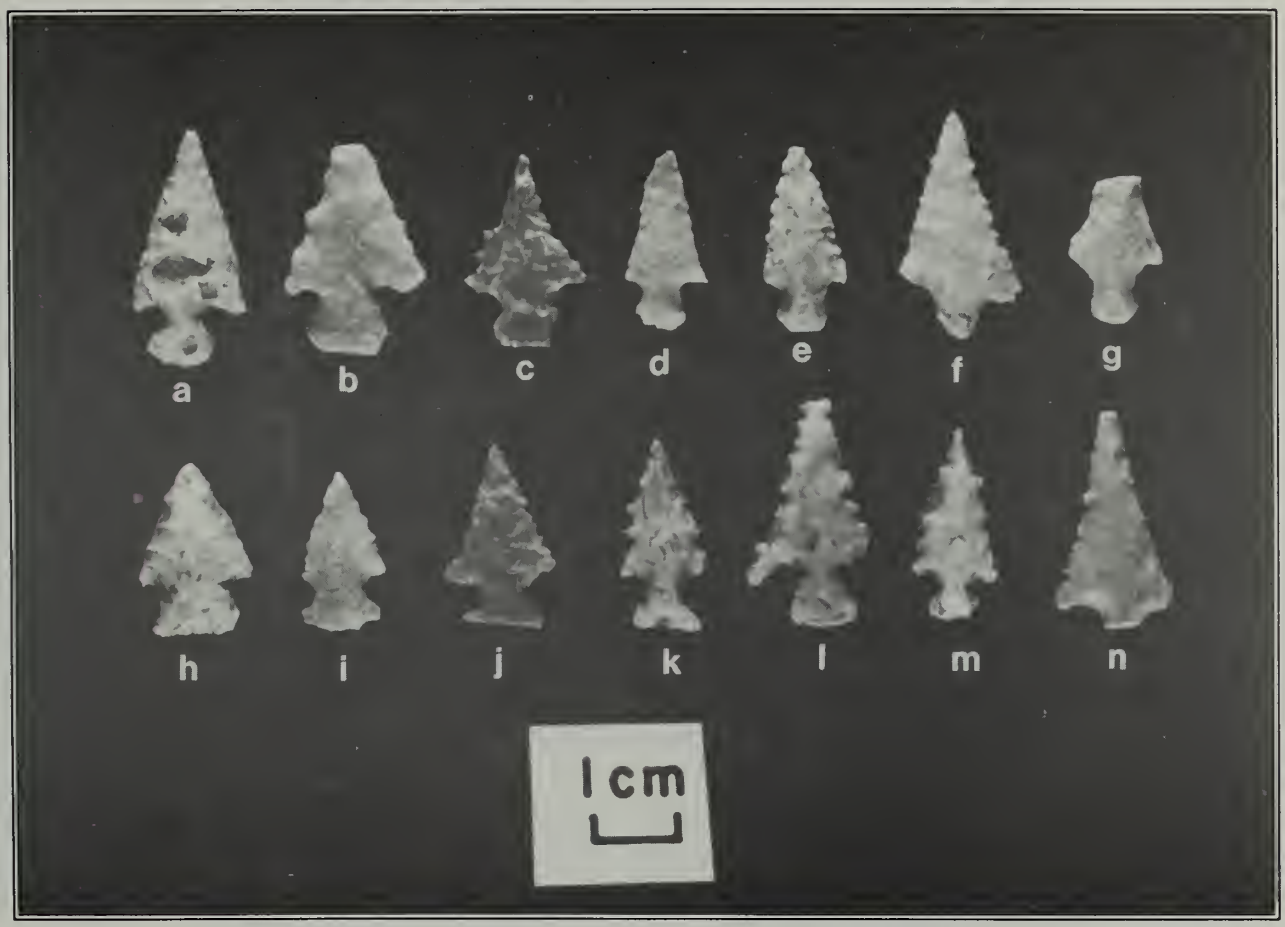


Figure 10-1. Arrowpoints from Stratum 5: Scallorn (a-j, m-n); Pocola (k), Agee A (l) (AAS Neg. #894515).

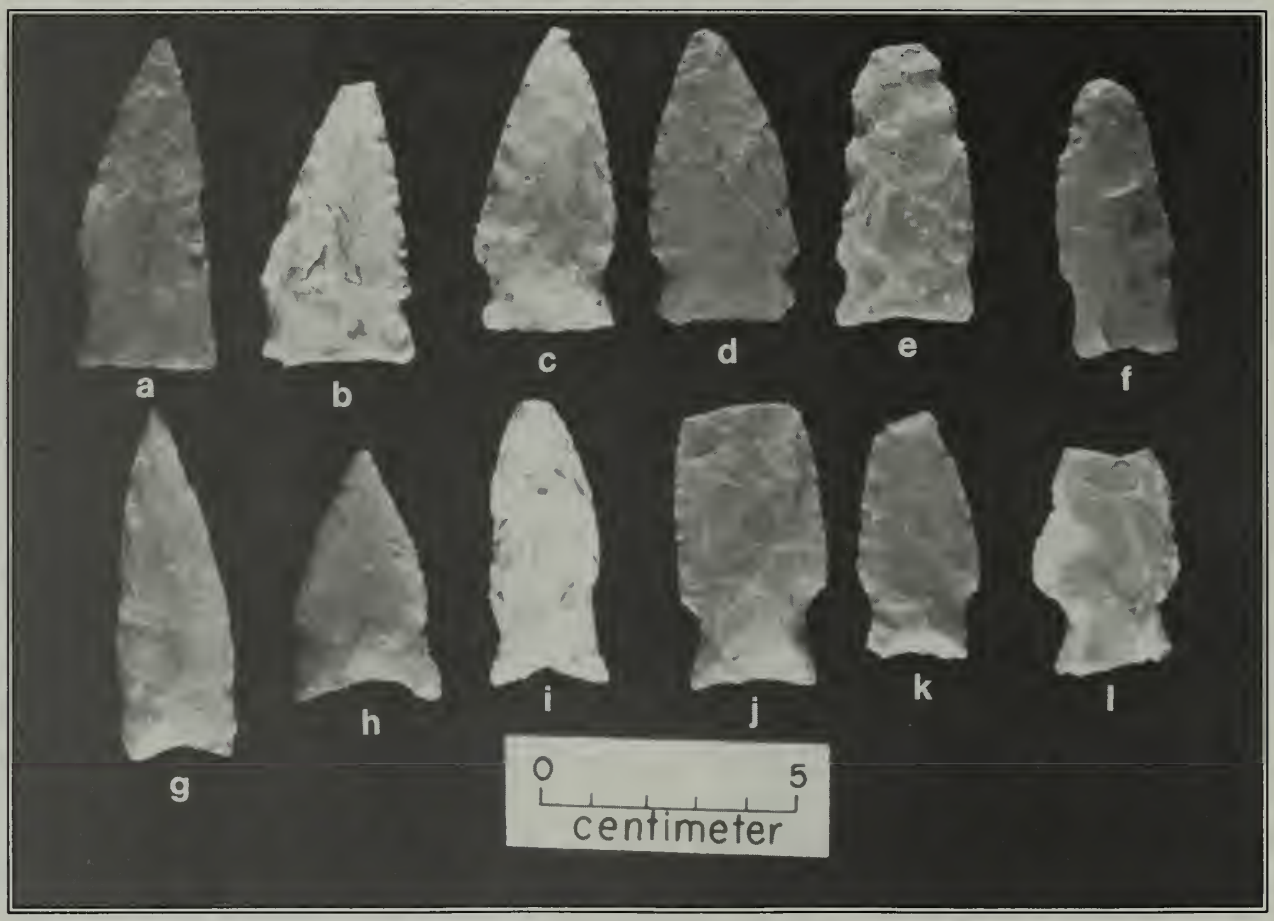


Figure 10-2. Rice notched points from Stratum 5 (AAS Neg. #894497).

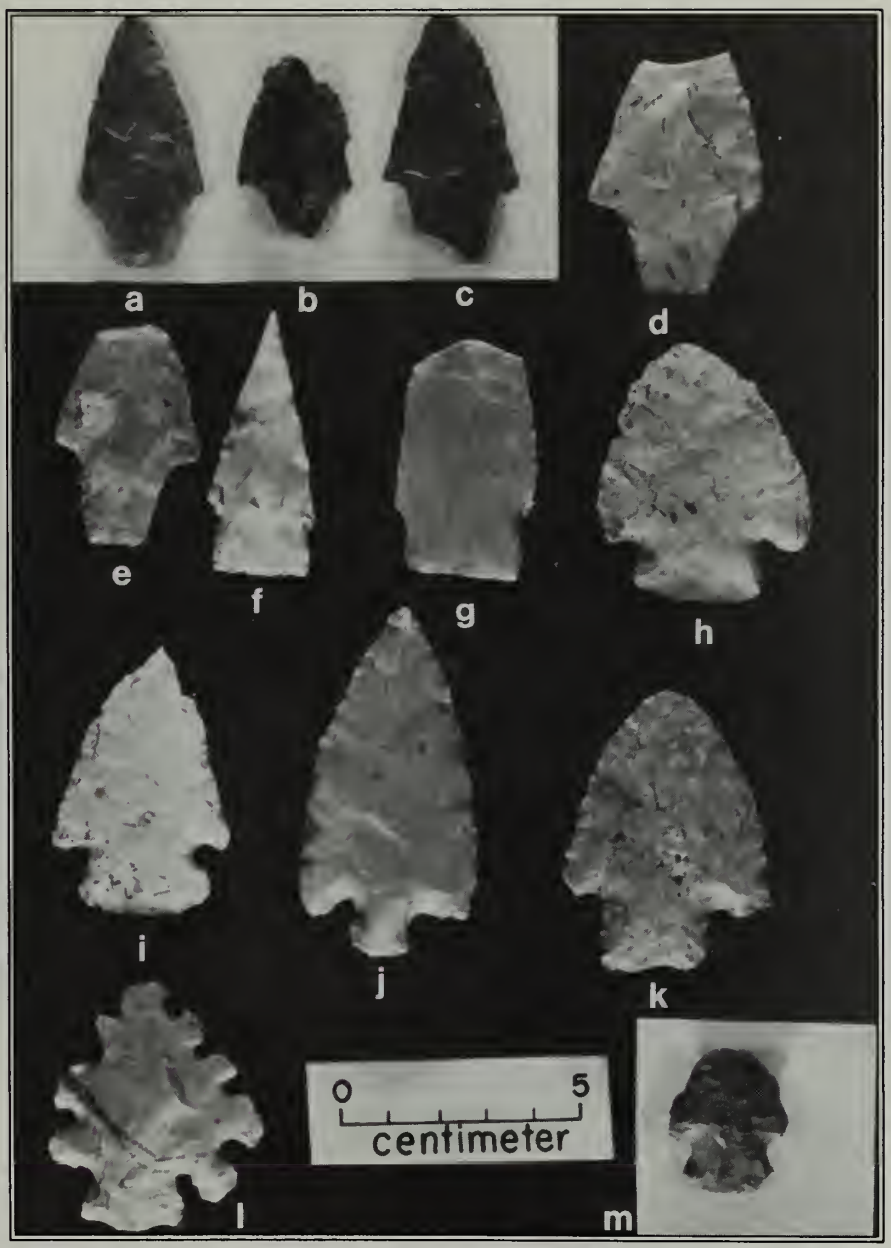


Figure 10-3. Dart points from Stratum 5: a = Gary *var. Gary*; b = Gary *var. Le Flore*; c-e = Langtry; f-m = Archaic points (AAS Neg. #894495).

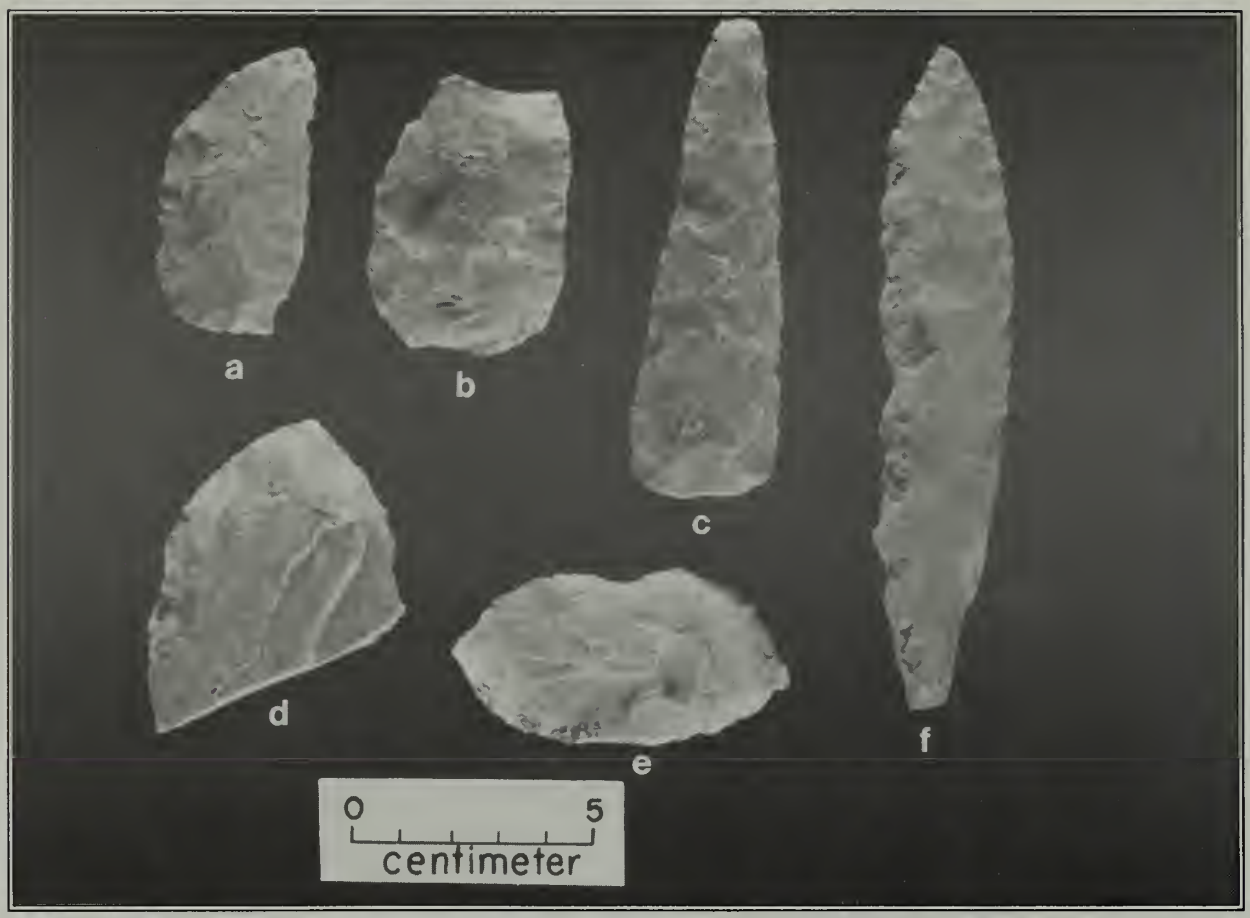


Figure 10-4. Knives and biface cutting tools (AAS Neg. #894442).



Figure 10-5. Flake tools from Stratum 5: a-c = side scrapers; d-f = end scrapers; g = graver; h = drill/awl; i = thumbnail scraper; j = spokeshave; k = denticulate scraper (AAS Neg. #894437).



Figure 10-6. Woodworking tools from Stratum 5 (AAS Neg. #894431).



Figure 10-7. Cores from Stratum 5: a-b = tabular cores; c-d = pebble cores; e = shaped core; f-h = unprepared core (AAS Neg. #894423).



Figure 10-8. Core tools from Stratum 5 (AAS Neg. #894434).

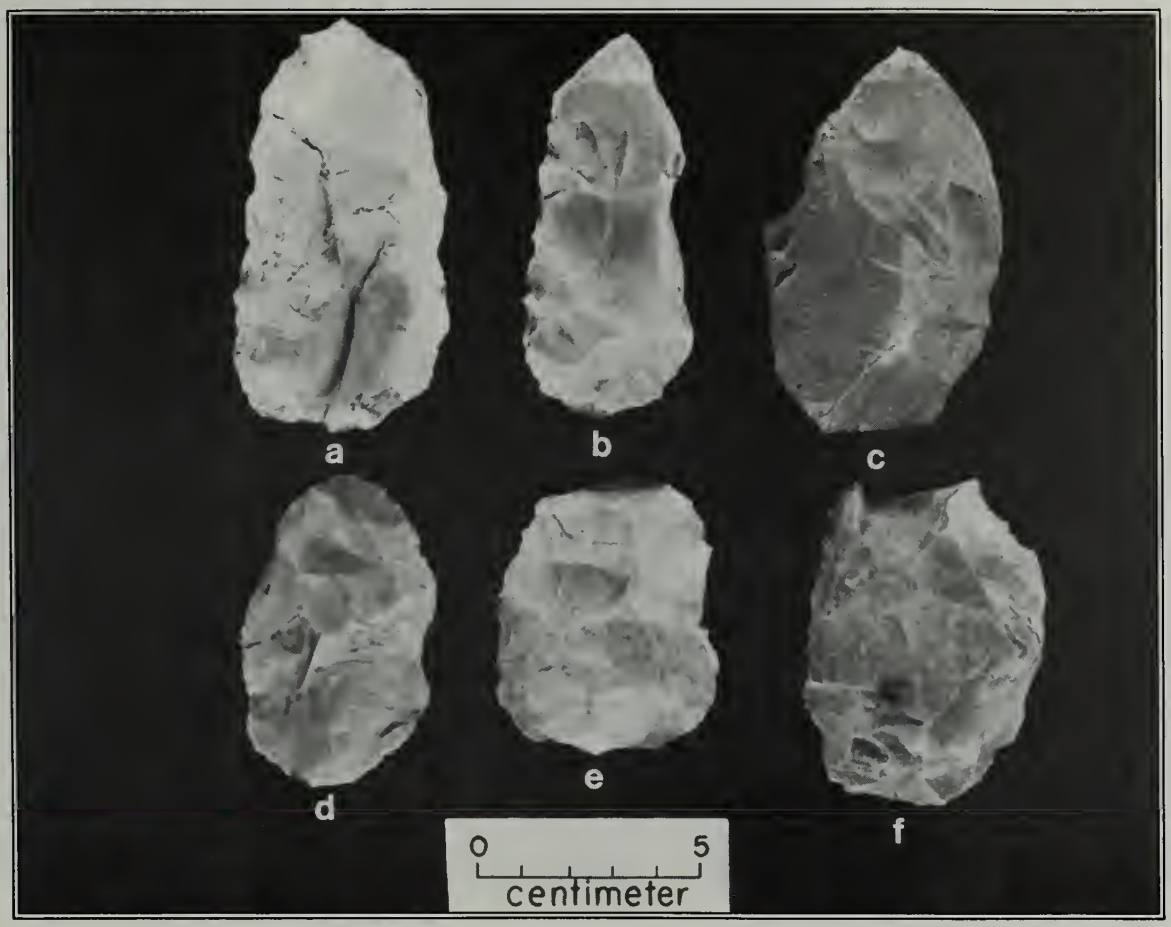


Figure 10-9. Initial preforms from Stratum 5 (AAS Neg. #894427).

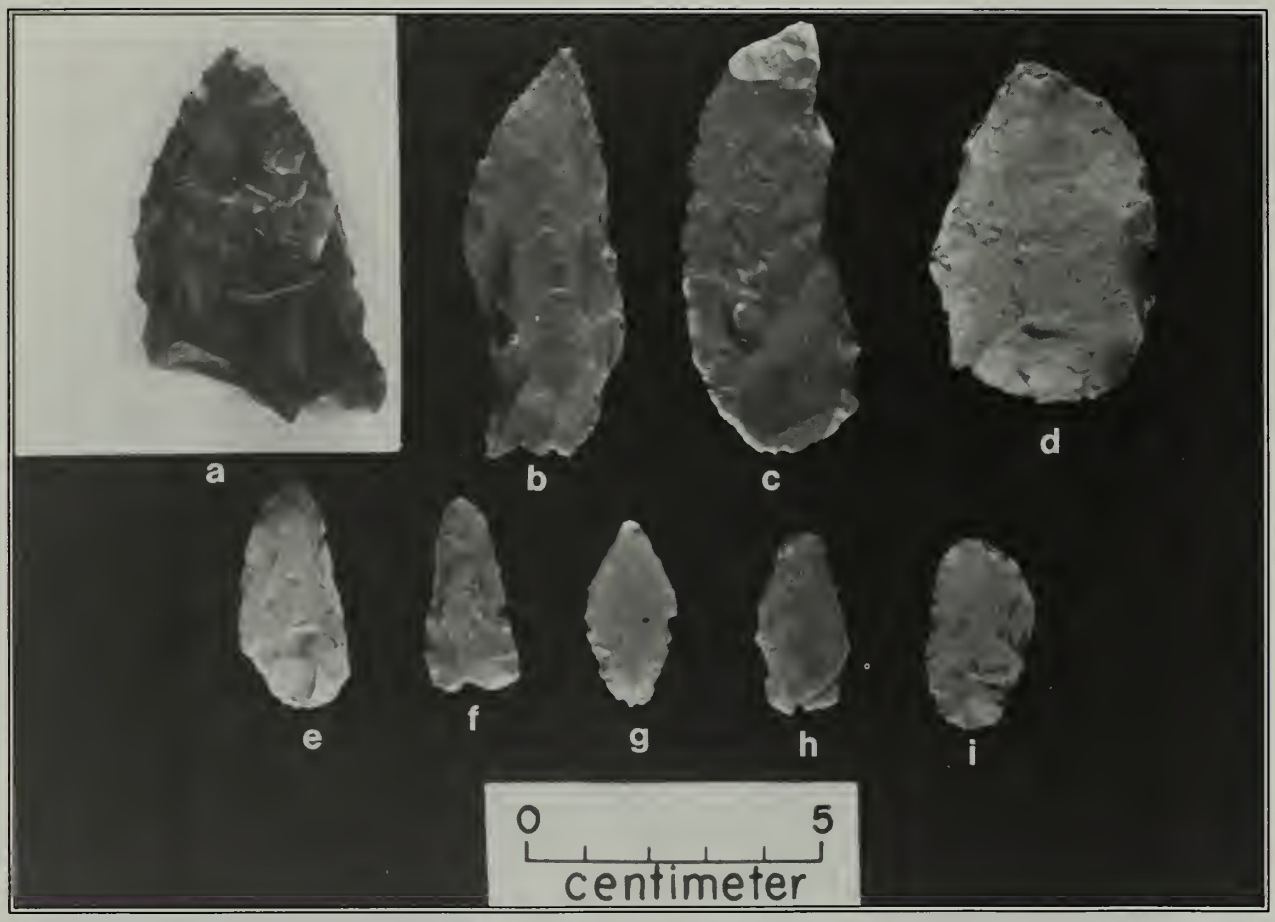


Figure 10-10. Advanced preforms from Stratum 5: a-d = dart preforms; e-i = arrow preforms (AAS Neg. #894446).

The assemblage of ground stone artifacts from the midden component was quite limited, consisting of three manos, three pitted stones, and two cobbles exhibiting polished surfaces. All of these specimens are made of sandstone. Seven pieces of decomposing limestone may have been used as a source of white pigment.

The distribution of raw material types in the stone tool assemblage is shown in Tables 10-3 and 10-4, and illustrated in Figures 10-11 and 10-12. These data indicate once again the extensive use of cherts from the Boone, St. Joe, and Reeds Spring formations. In the living floor assemblage, artifacts made of the Boone cherts occur in somewhat greater frequency than those of the other two cherts, whereas in the midden itself the St. Joe cherts were used to make the largest number of artifacts. Whether this represents a shift in preference over time, or a misrepresentation in our sample cannot be determined at present. Both the living floor and midden samples contain small numbers of artifacts made of nonlocal cherts and quartzite.

Turning now to other evidence concerning stone tool manufacture, Tables 10-5 and 10-6 show that while heat treatment is represented among most categories of finished artifacts, only about 40 percent of the total number of artifacts from both contexts were thermally altered in the manufacturing process. None of the heavy woodworking implements exhibits evidence of heat treatment, for some unknown reason. A substantial number of artifacts--about 30 percent of the combined totals for both contexts--also retain cortex on their surfaces (Tables 10-7 and 10-8). If the cores are removed from this sample, the percentage of finished artifacts with cortex is reduced somewhat. Still, quite a few specimens were made apparently without concern for complete decortication.

The debitage assemblages from the midden and living floor are presented in Tables 10-9 to 10-14. Figures 10-13 and 10-14 illustrate the raw material distributions for combined debitage assemblages from the living floor and midden contexts. These graphics show that the debitage assemblages reflect basically the same pattern of raw material utilization as that observed within the finished tool assemblages from Stratum 5. Examination of the distribution of raw material types within the individual flake categories (Figures 10-15 to 10-18) makes it possible to identify additional elements of this pattern of raw material usage during the Woodland period. Figure 10-16 shows that flakes of St. Joe and Boone cherts are favored for expedient tool utilization, although the larger sample of edge-modified flakes from the midden layer does contain examples representing other chert types. Among the shatter categories, it can also be seen that utilization of Boone cherts in stone tool making produced quite large amounts of angular debitage (Figure 10-17). The proportions of flakes to shatter for each chert group is illustrated in the histograms shown on Figures 10-19 and 10-20. These also show a disproportionate incidence of shatter from Boone cherts, which may indicate that the Middle to Late Woodland occupants of the Rush site were not heat treating this material to the same extent as their Early Woodland predecessors.

Further insights concerning the manufacture of stone tools in this component can be gained by examining the size grade distribution for the flake debitage. The tabulated data, when displayed on cumulative percentage graphs (Figures 10-21 and 10-22), show that, for the most part, flakes smaller than the 2.54 cm size grade are being produced. However, the Boone, St. Joe, and Reeds Spring cherts are being used in ways that pro-

duced some amount of debitage in the 2.54 cm size grade. Combined with the fact that some of the cores from this component are considerably larger than the 5.08 size grade, this may indicate the reduction of a few larger, quarried cobbles at the site. On the other hand, most of the flakes from the midden component occur in size grades smaller than the average sizes of finished tools (Table 10-15 and 10-16), indicating that flakes were probably used as blanks only for the smallest finished tool categories. Otherwise, preforms for larger tools were probably fashioned directly from locally gathered chert pebbles and cobbles.

Table 10-3. Raw material for chipped stone artifacts, Stratum 5 (midden).

	L BOONE	G BOONE		STJOEG	REEDSG		PITKIN		JEFCIT		UNID	TOTAL	
	B BOONE			STJOEJ		REEDSB		COTTER		QZIT			
Arrow	15	9		5	7	5				1	2	44	
Dart	13	11		17	5	11	5	15	1	1	4	83	
Knife	1			1						1		3	
Biface	33	19		26	12	19	3	15	2	3	2	8	142
Hafted bi				1		1					1		3
End scr		2		2		1					1		6
Side scr										1			1
Sd & end scr	1												1
Thumb scr						1							1
Spokeshave		1				1							2
Dent scr	1												1
Drill				1									1
Drill/awl						1							1
Perf/graver				1									1
Graver		1						1					2
Blade	2	1		5	3	2					1		14
Core tool		1		1	1								3
Arrow pre	1	2		3	1	1		1			1		10
Dart pre	1			2	1			2					6
Other pre	12	5		24	16	28		2	1		8		96
Tab core		1		1	4	3							9
Pebble core	16	5	3	5	4		1	1	1		5		41
Shaped core		1		4		1							6
Unpre core	16	6		17	7	18	3	1		2	2		72
Burin spall	1	6											7
Hammer	2												2
Test pebble	9												9
Test cobble	4												4
Adze	3	1	1	2		3					1		11
Axe											1		1
Celt					1								1
Total	131	72	4	118	62	96	12	38	5	5	8	33	584

Table 10-4. Raw material for chipped stone artifacts, Stratum 5 (living floor).

	L BOONE	B BOONE	STJOEJ	REEDSB	COTTER	QZIT				
	G BOONE	STJOEG	REEDSG	PITKIN	JEFCIT		UNID	TOTAL		
Arrow			3					3		
Dart	1			1	1		1	4		
Knife				1				1		
Biface		2	1	3			3	9		
Hafted bi		1		1			1	3		
End scr					1			1		
Side scr	2					1		3		
Blade						1		1		
Core tool			1				1	2		
Dart pre				1				1		
Other pre	5		1	1	4		1	1	13	
Tab core			1					1		
Pebble core	1	2						3		
Unpre core	3	2	1	3	4			2	15	
Hammer	1								1	
Test pebble	3		1	1					5	
Test cobble	2								2	
Adze	1							1	2	
Total	19	7	9	6	14	2	3	2	8	70

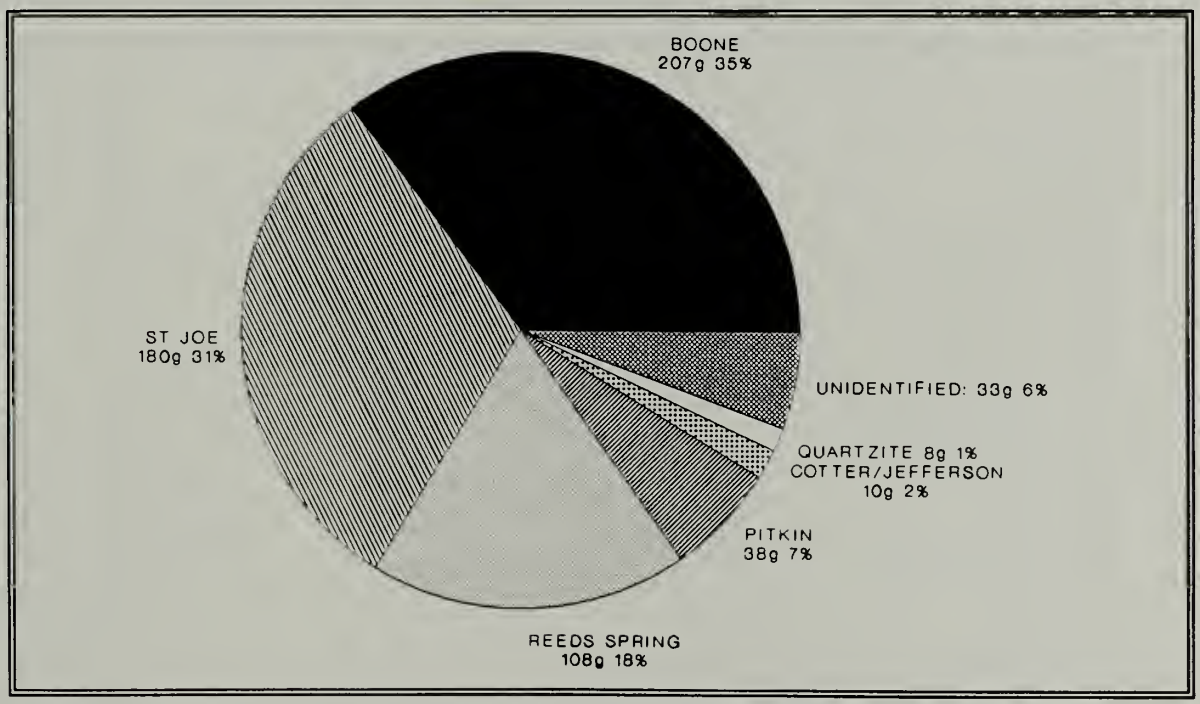


Figure 10-11. Raw material groups for Stratum 5 midden (chipped lithics).

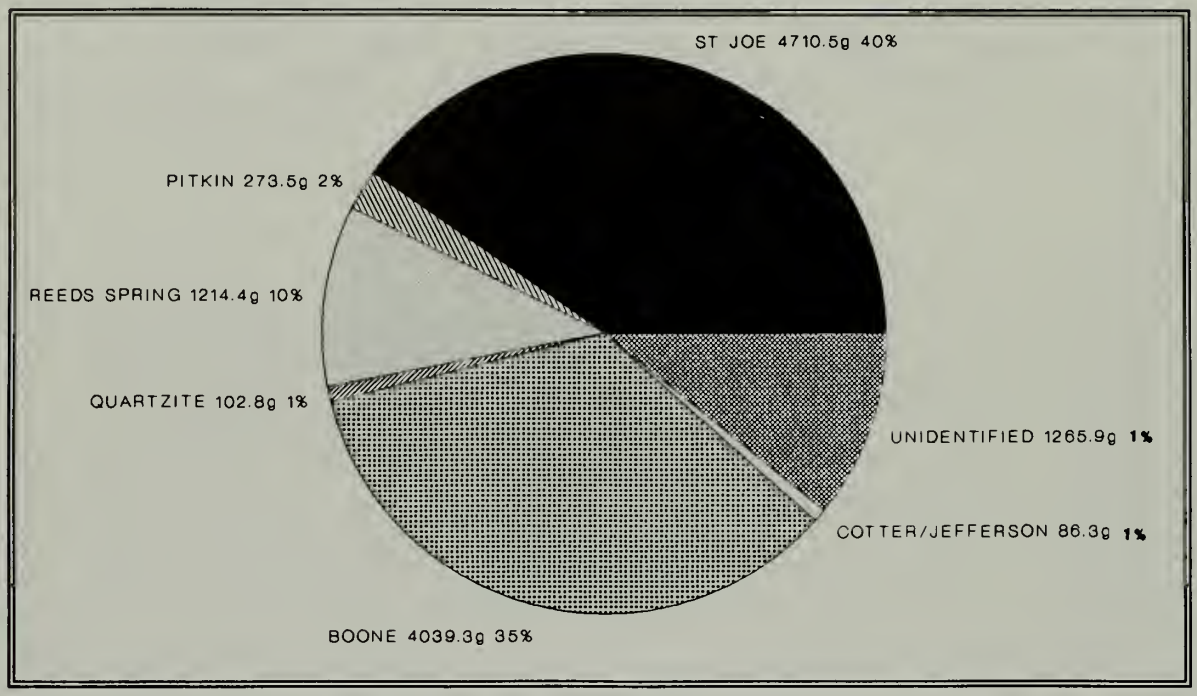


Figure 10-12. Raw material groups for Stratum 5 living floor (chipped lithics).

Table 10-5. Heat treated artifacts, Stratum 5 (midden).

	HT	Not HT	Total
Arrow	17	27	44
Dart	28	55	83
Knife		3	3
Other biface	59	83	142
Other hafted beface		3	3
End scraper	4	2	6
Side scraper	1		1
Side and End scraper		1	1
Thumbnail scraper		1	1
Spokeshave	1	1	2
Denticulate scraper	1		1
Drill		1	1
Drill/awl		1	1
Perforator/graver		1	1
Graver	1	1	2
Blade	6	8	14
Core tool	2	1	3
Arrow preform	6	4	10

Table 10-5. Continued.

	HT	Not HT	Total
Dart preform	5	1	6
Other preform	58	38	96
Tabular core	4	5	9
Pebble core	12	29	41
Shaped core	4	2	6
Unprepared core	30	42	72
Tested pebble		9	9
Tested cobble		4	4
Burin spall		7	7
Hammer		2	2
Adze		11	11
Axe		1	1
Celt	1		1
Total	240 (41%)	344 (59%)	584

Table 10-6. Heat treated artifacts, Stratam 5 (living floor).

	HT	Not HT	Total
Arrow	2	1	3
Dart	1	3	4
Knife		1	1
Other biface	4	5	9
Other hafted beface	2	1	3
End scraper	1		1
Side scraper		3	3
Blade		1	1
Core tool	1	1	2
Dart preform	1		1
Other preform	6	7	13
Tabular core	1		1
Pebble core		3	3
Unprepared core	7	8	15
Tested pebble		5	5
Tested cobble		2	2
Hammer		1	1
Adze		2	2
Total	26 (37%)	44 (63%)	70

Table 10-7. Chipped stone artifacts with cortex, Stratum 5 (midden).

	Cortex	No Cortex	Total
Arrow		44	44
Dart	1	82	83
Knife		3	3
Other biface	7	135	142
Other hafted biface		3	3
End scraper	1	5	6
Side scraper	1		1
Side and end scraper		1	1
Thumbnail scraper		1	1
Spokeshave		2	2
Denticulate scraper		1	1
Drill		1	1
Drill/awl	1		1
Perforator/graver		1	1
Graver		2	2
Blade	5	9	14
Core tool	3		3
Arrow preform	1	9	10
Dart preform		6	6
Other preform	23	73	96
Tabular core	7	2	9
Pebble core	36	5	41
Shaped core	4	2	6
Unprepared core	49	23	72
Tested pebble	9		9
Tested cobble	4		4
Burin spall		7	7
Hammer	2		2
Adze	5	6	11
Axe	1		1
Celt	1		1
Total	161 (28%)	423 (72%)	584

Table 10-8. Chipped stone artifacts with cortex, Stratum 5 (living floor).

	Cortex	No Cortex	Total
Arrow		3	3
Dart		4	4
Knife	1		1
Other biface	1	8	9
Other hafted biface		3	3
End scraper		1	1
Side scraper	2	1	3
Blade		1	1
Core tool	1	1	2
Dart preform		1	1
Other preform	3	10	13
Tabular core	1		1
Pebble core	3		3
Unprepared core	10	5	15
Tested pebble	5		5
Tested cobble	2		2
Adze	1	1	2
Total	31 (44%)	39 (56%)	70

Table 10-9. Weights of unmodified flakes, Stratum 5 (midden).

	L BOONE	B BOONE	STJOEJ	REEDSB	COTTER	QZIT						
	G BOONE		STJOEG	REEDSG	PITKIN		JEFCIT		UNID		TOTAL	
Size Grade												
5.08												
3.81	62.8						42.6		34.4		139.8	
2.54	230.2	78.0	196.9	81.4	44.4				159.3		790.2	
1.27	895.0	544.5	11.9 1541.0	743.0	767.7	0.8	119.1	8.9	15.6	10.9	352.4	5010.8
0.64	486.1	576.3	0.6 926.9	565.2	309.0	2.0	127.0	4.2	12.2	36.5	474.6	3520.6
Total	1674.1	1198.8	12.5 2664.8	1389.6	1121.1	2.8	46.1	13.1	70.4	47.4	1020.7	9461.4

Table 10-10. Weights of modified flakes, Stratum 5 (midden).

	L BOONE	B BOONE		STJOEJ	REEDSB		COTTER		QZIT		
	G BOONE		STJOEG		REEDSG	PITKIN		JEFCIT		UNID	TOTAL
Size Grade											
5.08											
3.81											
2.54	18.3	28.0		26.2	53.4	20.6				35.0	181.5
1.27	32.9	27.0	14.4	76.4	46.5	23.0		16.0			236.2
0.64		0.9		1.3	1.8		1.2		0.7		5.9
Total	51.2	55.9	14.4	103.9	101.7	43.6	1.2	16.0	0.7	35.0	423.6

Table 10-11. Weights of shatter, Stratum 5 (midden).

	L BOONE	B BOONE		STJOEJ	REEDSB		COTTER			QZIT	
	G BOONE		STJOEG		REEDSG		PITKIN		JEFCIT	UNID	TOTAL
Size Grade											
5.08											
3.81	88.1	181.6		86.0							355.7
2.54	156.7	11.5	44.5	23.9	39.8					52.5	328.9
1.27	187.4	164.6	17.4	107.6	108.8	25.4		3.4		53.1 108.9	776.6
0.64	64.5	116.1		26.5	57.9	19.5	0.8	8.0	0.4	1.7 2.3 48.8	346.5
Total	496.7	473.8	61.9	244.0	206.5	44.9	0.8	11.4	0.4	1.7 55.4 210.2	1807.7

Table 10-12. Weights of unmodified flakes, Stratum 5 (living floor).

	L BOONE	B BOONE		STJOEJ	REEDSB		COTTER			QZIT	
	G BOONE		STJOEG		REEDSG		PITKIN		JEFCIT	UNID	TOTAL
Size Grade											
5.08											
3.81										44.4	44.4
2.54	252.3	28.2		100.1	46.6	34.5				2.8	464.5
1.27	237.6	65.0	.70	124.3	114.7	148.9	2.1	20.8	1.8 11.2	6.7 52.7	786.5
0.64	96.0	51.6		99.3	83.4	54.7	0.2	13.9	0.4 0.7	4.2 42.2	446.6
Total	585.9	144.8	.70	323.7	244.7	238.1	2.3	34.7	2.2 11.9	13.7 139.3	1742.0

Table 10-13. Weights of modified flakes, Stratum 5 (living floor).

	L BOONE	B BOONE	STJOEJ	REEDSB	COTTER	QZIT		
	G BOONE	STJOEG	REEDSG	PITKIN	JEFCIT	UNID	TOTAL	
Size Grade								
5.08								
3.81								
2.54								
1.27	3.7	10.3	9.8	5.4				29.2
0.64								
Total	3.7	10.3	9.8	5.4				29.2

Table 10-14. Weights of shatter, Stratum 5 (living floor).

	L BOONE	B BOONE	STJOEJ	REEDSB	COTTER	QZIT		
	G BOONE	STJOEG	REEDSG	PITKIN	JEFCIT	UNID	TOTAL	
Size Grade								
5.08								
3.81	104.5							104.5
2.54	34.7	3.8	7.2			2.7		48.5
1.27	9.2	3.9	5.1	0.3				18.5
0.64						6.6		6.6
Total	148.4	7.7	12.3	0.3		9.3		178.0

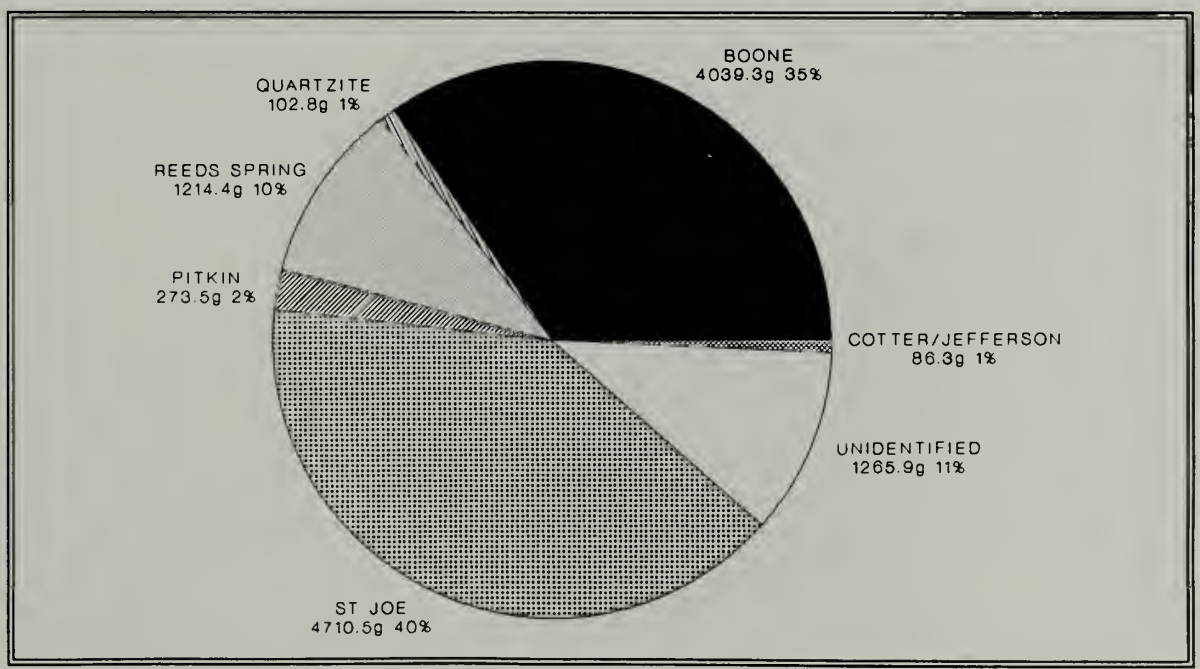


Figure 10-13. Raw material groups for Stratum 5 midden (combined debitage).

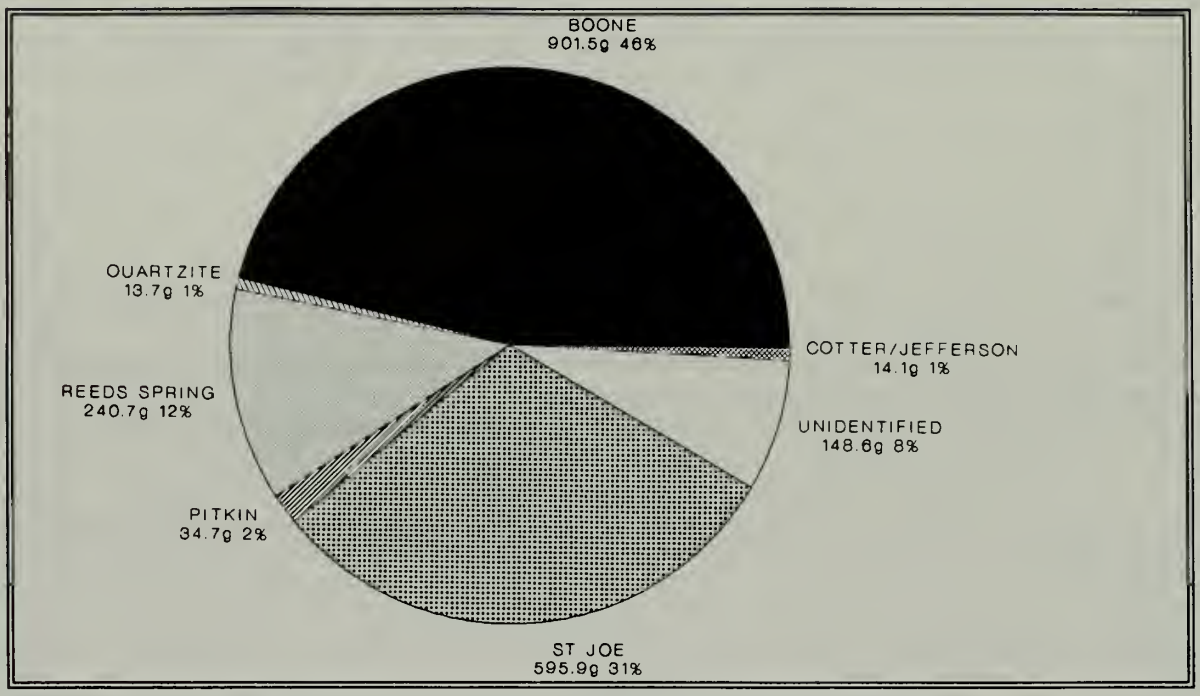


Figure 10-14. Raw material groups for Stratum 5 living floor (combined debitage).

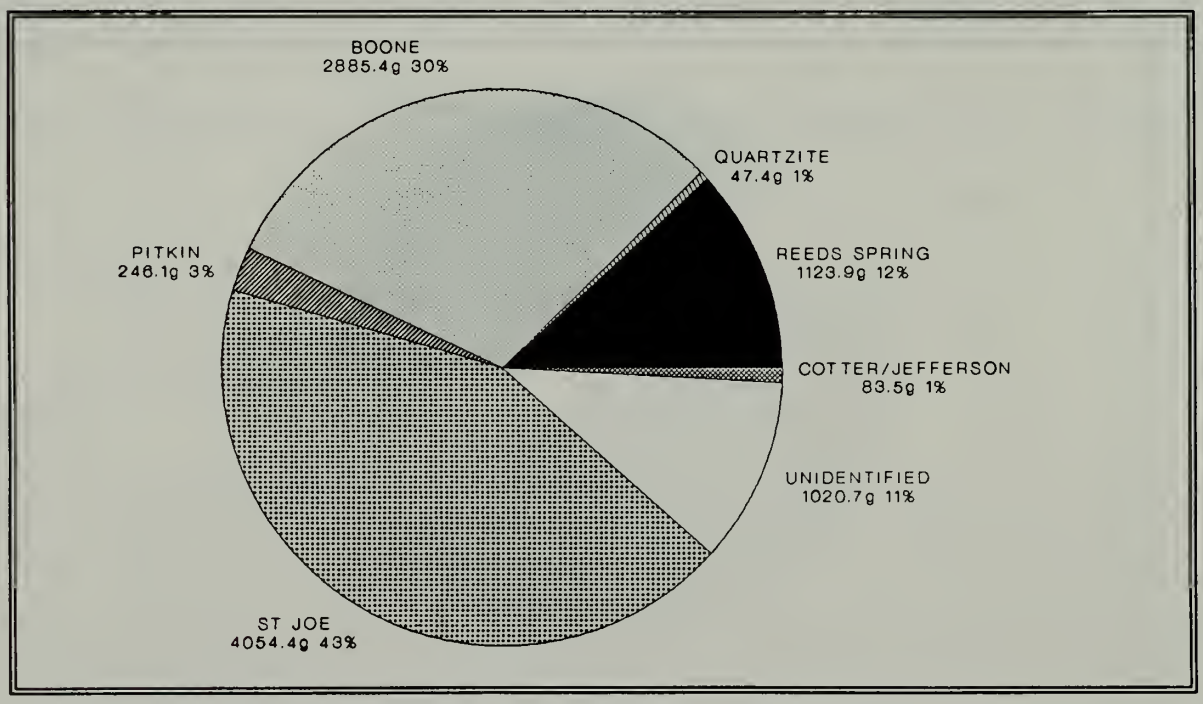


Figure 10-15. Raw material groups for Stratum 5 midden (unmodified flakes).

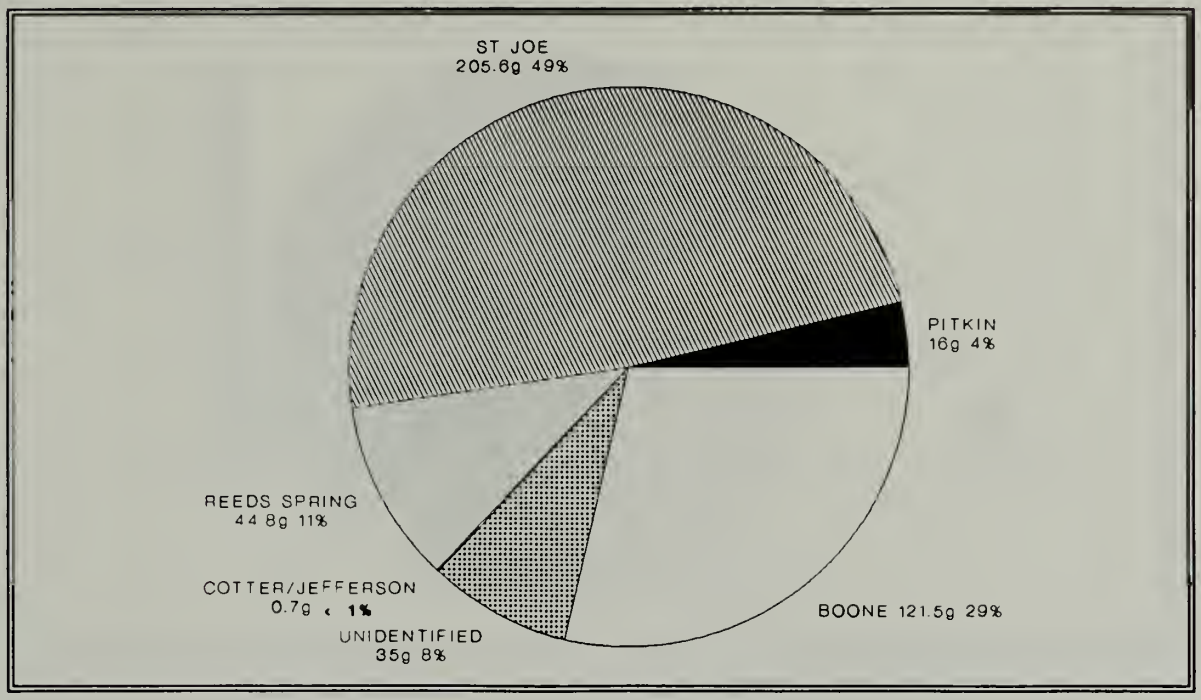


Figure 10-16. Raw material groups for Stratum 5 midden (modified flakes).

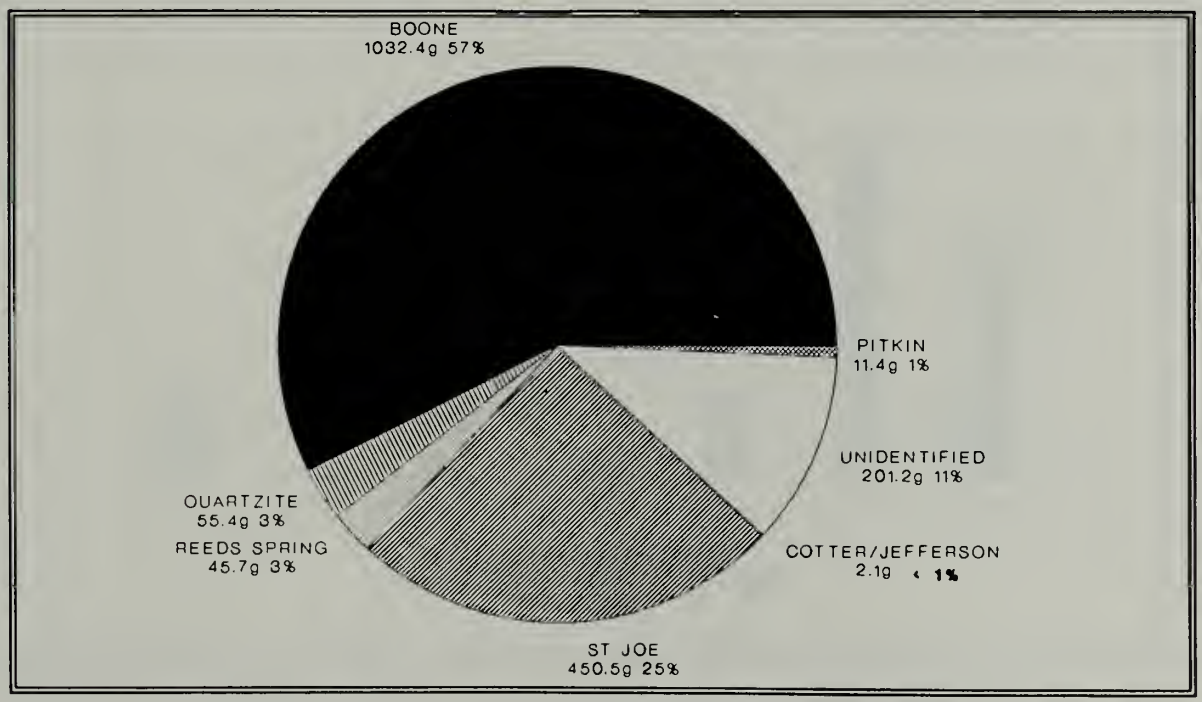


Figure 10-17. Raw material groups for Stratum 5 midden (shatter).

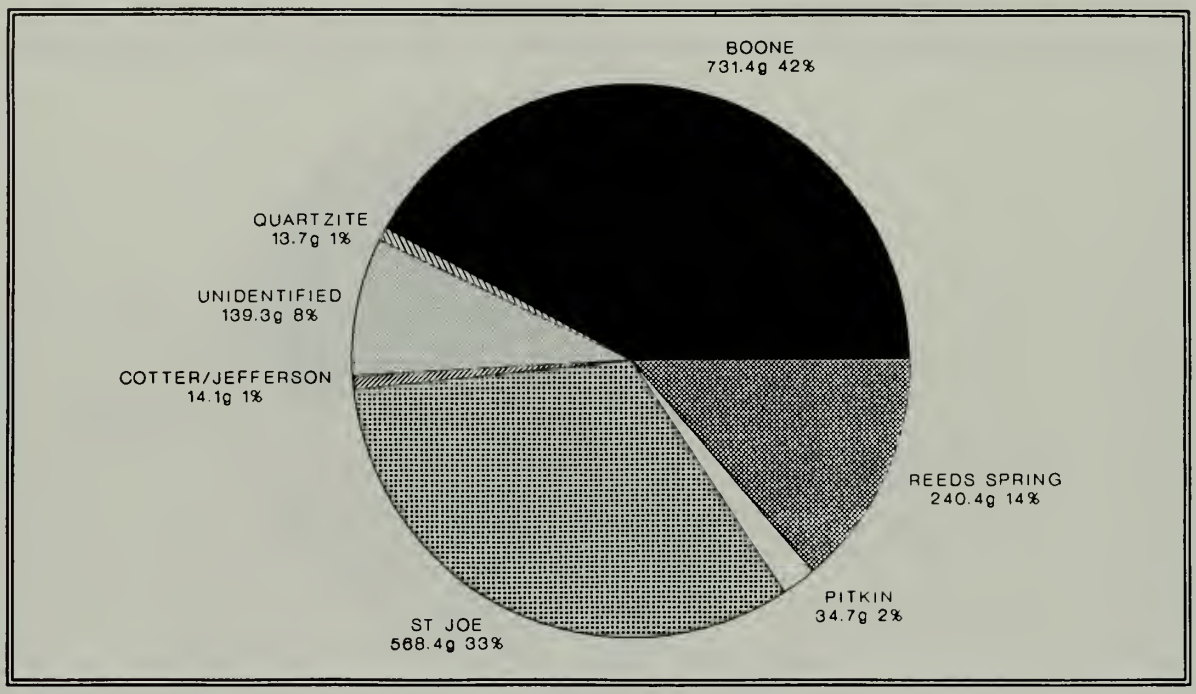


Figure 10-18. Raw material groups for Stratum 5 living floor (unmodified flakes).

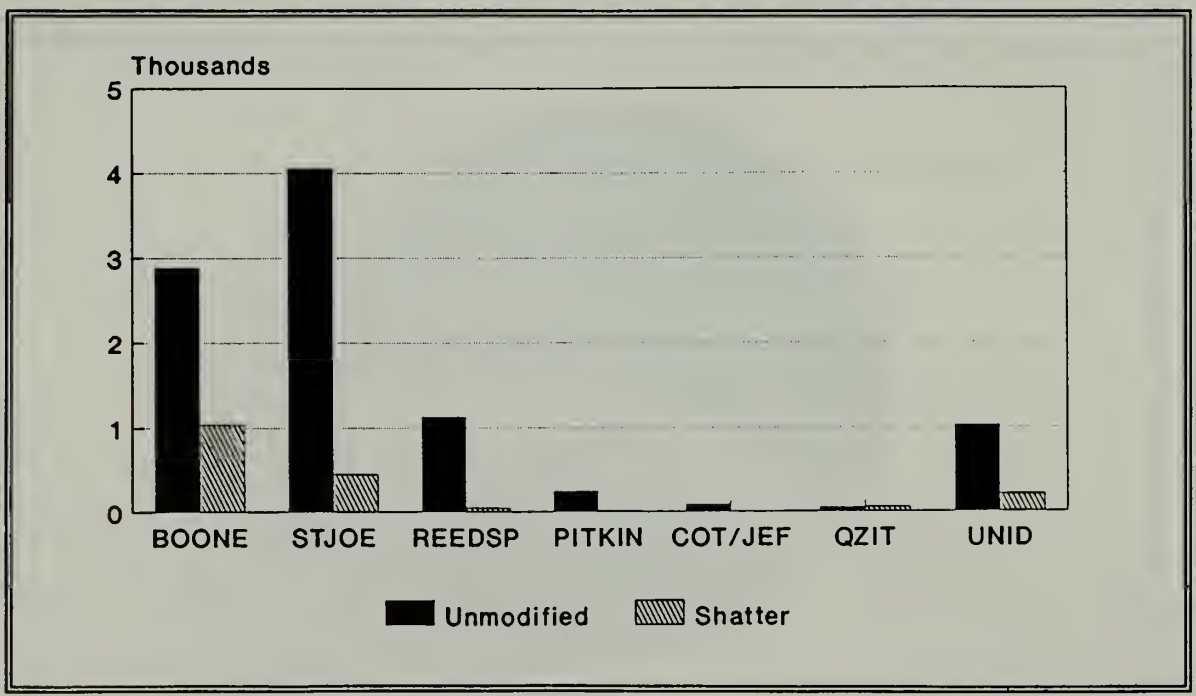


Figure 10-19. Proportions of unmodified flakes and shatter by weight for each raw material type for Stratum 5 midden.

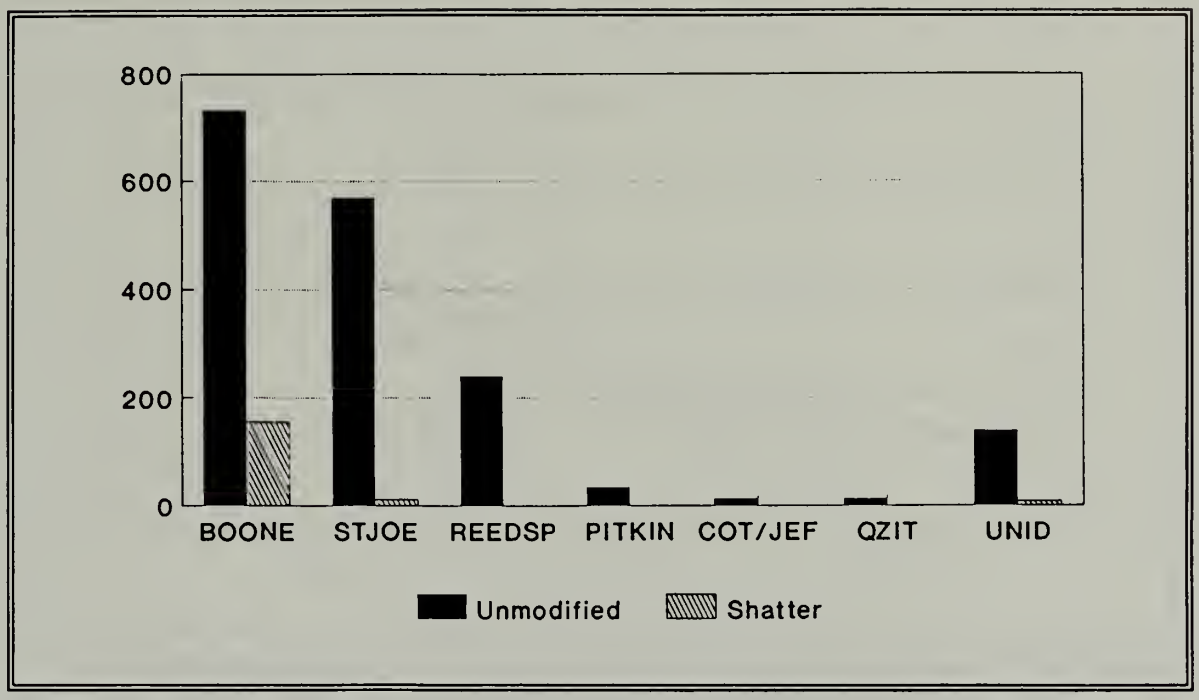


Figure 10-20. Proportions of unmodified flakes and shatter by weight for each raw material type for Stratum 5 living floor.

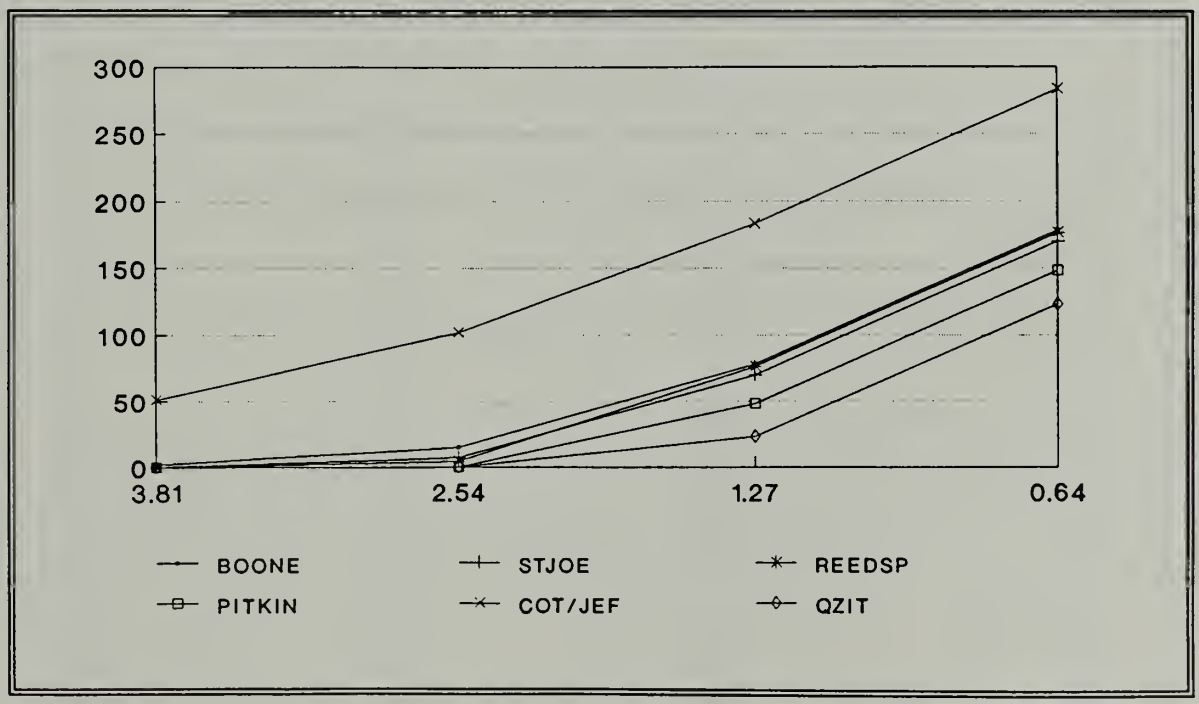


Figure 10-21. Cumulative percentage graph showing distribution by weight of unmodified flake sizes for each raw material type for Stratum 5 midden.

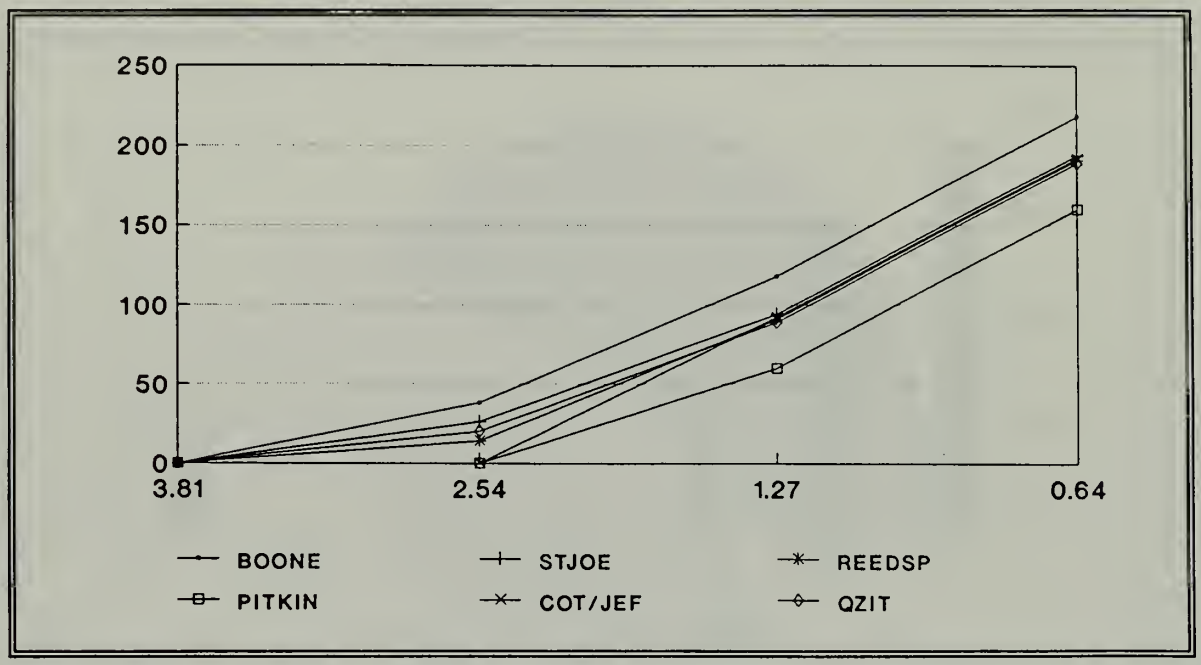


Figure 10-22. Cumulative percentage graph showing distribution by weight of unmodified flake sizes for each raw material type for Stratum 5 living floor.

Table 10-15. Chipped stone artifact size ranges (in cm), Stratum 5 (midden).

	Minimum	Maximum	Average
Arrow	1.74	2.85	2.16
Dart	2.93	7.49	5.87
Knife	6.15	10.00	7.75
Other biface	4.48	4.64	4.56
End scraper	2.64	4.82	3.78
Side scraper	4.80	4.80	4.80
Side and end scraper	5.68	5.68	5.68
Thumbnail scraper	1.96	1.96	1.96
Spokeshave	4.53	5.85	5.19
Denticulate scraper	4.68	4.68	4.68
Drill/awl	3.56	3.56	3.56
Perforator/graver	3.45	3.45	3.45
Graver	2.57	2.57	2.57
Blade	2.88	7.43	4.92
Arrow preform	3.07	3.86	3.39
Dart preform	4.15	6.98	5.86
Other preform	4.79	9.89	6.99
Adze	5.90	10.47	7.66
Axe	18.50	18.50	18.50
Celt	7.45	7.45	7.45

Table 10-16. Chipped stone artifact size ranges (in cm), Stratum 5 (living floor).

	Minimum	Maximum	Average
Dart	3.28	5.80	4.87
Knife	7.06	7.06	7.06
Other biface	5.80	5.80	5.80
Other hafted biface	13.73	13.73	13.73
End scraper	3.76	3.76	3.76
Side scraper	2.70	6.42	5.06
Blade	5.18	5.18	5.18
Dart preform	5.30	5.30	5.30
Other preform	6.90	6.90	6.90
Adze	10.54	10.54	10.54

The cumulative percentage line for the Cotter/Jefferson City group of cherts on Figure 10-21, which shows a percentage at the 3.81 cm size grade, is the result of a single large specimen of Jefferson City chert that was likely brought in to the site as a flake blank.

The subtractive processes model for the Middle to Late Woodland occupation at Rush is illustrated in Figure 10-23. Some elaborations within this model, as compared to the models for the earlier components, illustrate some developments worthy of note. In addition to the suggestion made above concerning the possibility of limited quarrying activity, the midden assemblage also contains evidence for the acquisition and processing of quartz crystal. This evidence is in the form of very small flakes and chunks of this material, all no larger than the 0.64 cm size grade. Quartz crystal occurs in caves and fissures in the local limestone bedrock, where, according to local information, it can be extracted in thumb sized pieces. The single stalagmite or stalagtite fragment found in the midden may thus have been brought back to the site after a quartz crystal mining foray by one of its Woodland period inhabitants.

It is possible only to speculate about the reasons why quartz crystal mining and processing were added to the repertoire of stoneworking activities during the Woodland period. However, the absence of any artifacts or even large pieces of quartz crystal may be significant. This might imply that quartz crystal was being collected and perhaps trimmed of adhering bedrock for trade to other communities rather than for on-site consumption. This interpretation is compatible with evidence for the utilization at 3MR80-Area D of other, nonlocal stone resources.

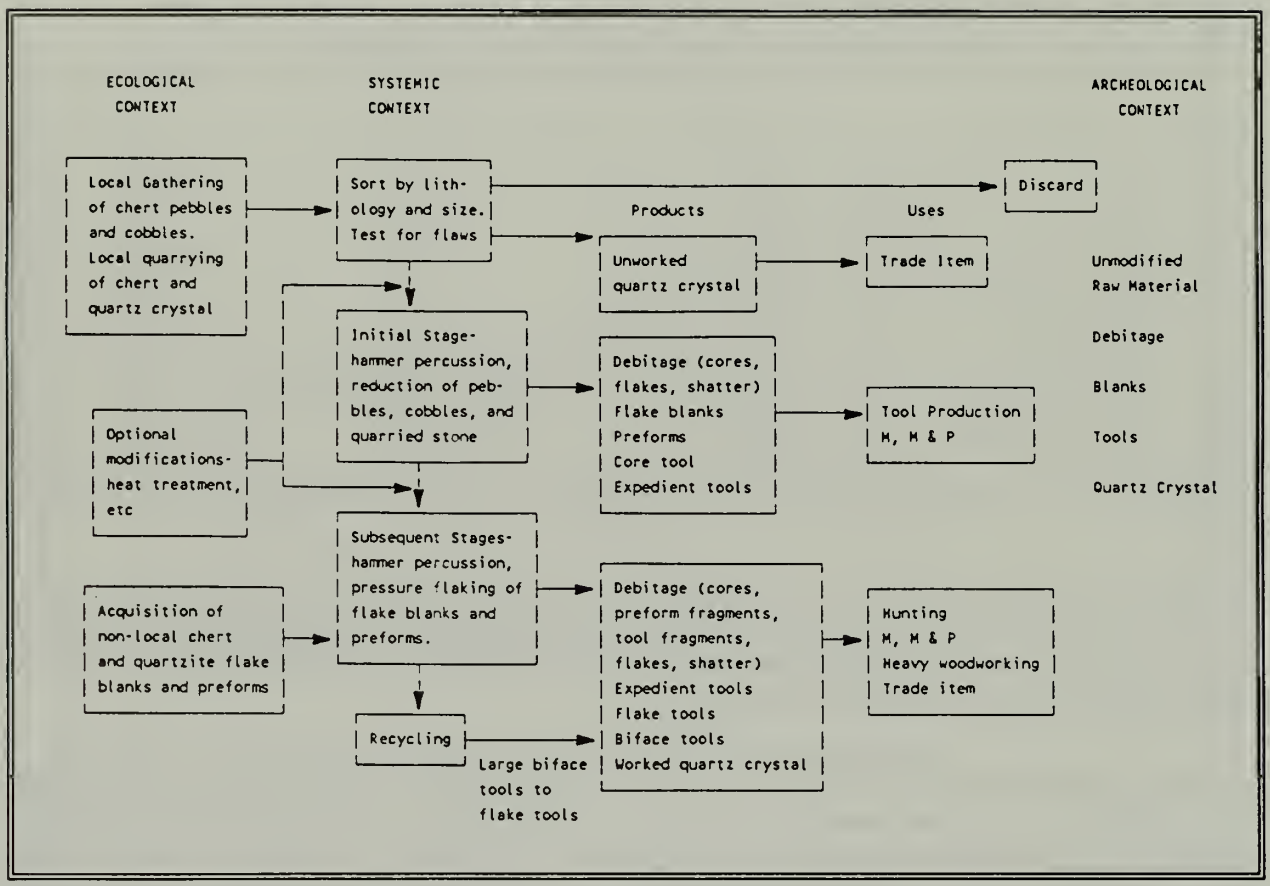


Figure 10-23. Chipped stone tool production model for the Middle to Late Woodland component of 3MR80-Area D.

Ceramics represent another highly significant constituent of the midden component artifact assemblage at this site. The sherd assemblage is listed on Tables 10-17 to 10-19, and a selection of rims and other specimens are illustrated on Figure 10-24. As can be seen, most of the rim sherds are undecorated, with the exception of a single lip incised example representing the Coles Creek type and a red filmed specimen. Rim profiles on these sherds are straight to slightly everted (Figure 10-25). Decoration is limited to a very few specimens, and includes the techniques of incising and cord impression. Most, if not all, of the undecorated rim sherds represent the type Woodward Plain. The most important feature of this assemblage, however, is the high proportion of shell tempering employed in the manufacture of this pottery (Figures 10-26 and 10-27). In the ceramic assemblages from the living floor and midden, about 75 percent are shell tempered, with the remainder containing grog, grog and bone, and bone and shell tempering.

Table 10-17. Ceramics, Stratum 5 (midden).

Temper	Sherd Category	N	Percent
Shell	Rim	7	04
	Body	136	67
	Base	4	02
Grog	Rim	4	02
	Body	28	14
	Base	1	01
Grog/bone	Rim	3	01
	Body	9	05
	Base	2	01
Grog/shell	Rim	2	01
	Body	-	
	Base	-	
Bone/shell	Rim	1	01
	Body	-	
	Base	1	01
Total		198	100
Unclassified sherds (less than 1.27 cm) = 419			

Table 10-18. Ceramics, Stratum 5 (living floor).

Temper	Sherd Category	N	Percent
Shell	Rim	-	
	Body	19	70
	Base	-	
Grog	Rim	-	
	Body	5	19
	Base	-	
Grog/bone	Rim	-	
	Body	1	04
	Base	-	
Bone/shell	Rim	-	
	Body	2	07
	Base	-	
Total		198	100
Unclassified sherds (less than 1.27 cm) = 31			

Table 10-19. Ceramics, Feature 4.

Temper	Sherd Category	N	Percent
Shell	Rim	5	08
	Body	49	78
	Base	1	02
	Coil	2	03
Grog	Rim	1	02
	Body	3	04
	Base	-	
Grog/shell	Rim	-	
	Body	2	03
	Base	-	
Bone/shell	Rim	-	
	Body	2	07
	Base	-	
Total		63	100
Unclassified sherds (less than 1.27 cm) = 91			

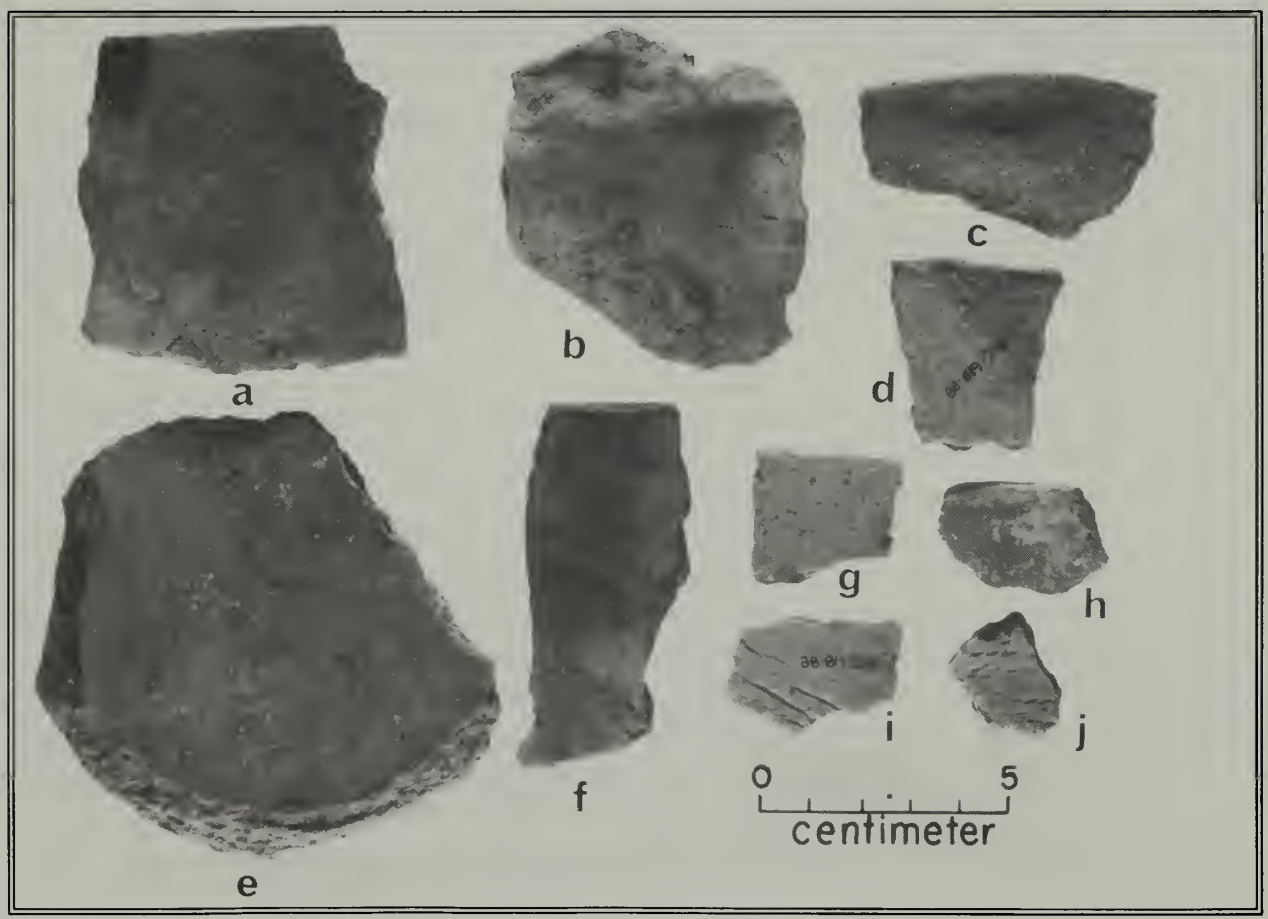


Figure 10-24. Ceramics from Stratum 5: a-d, f-h = rim sherds; e = base sherd; f-g = decorated sherds (AAS Neg. #894506).

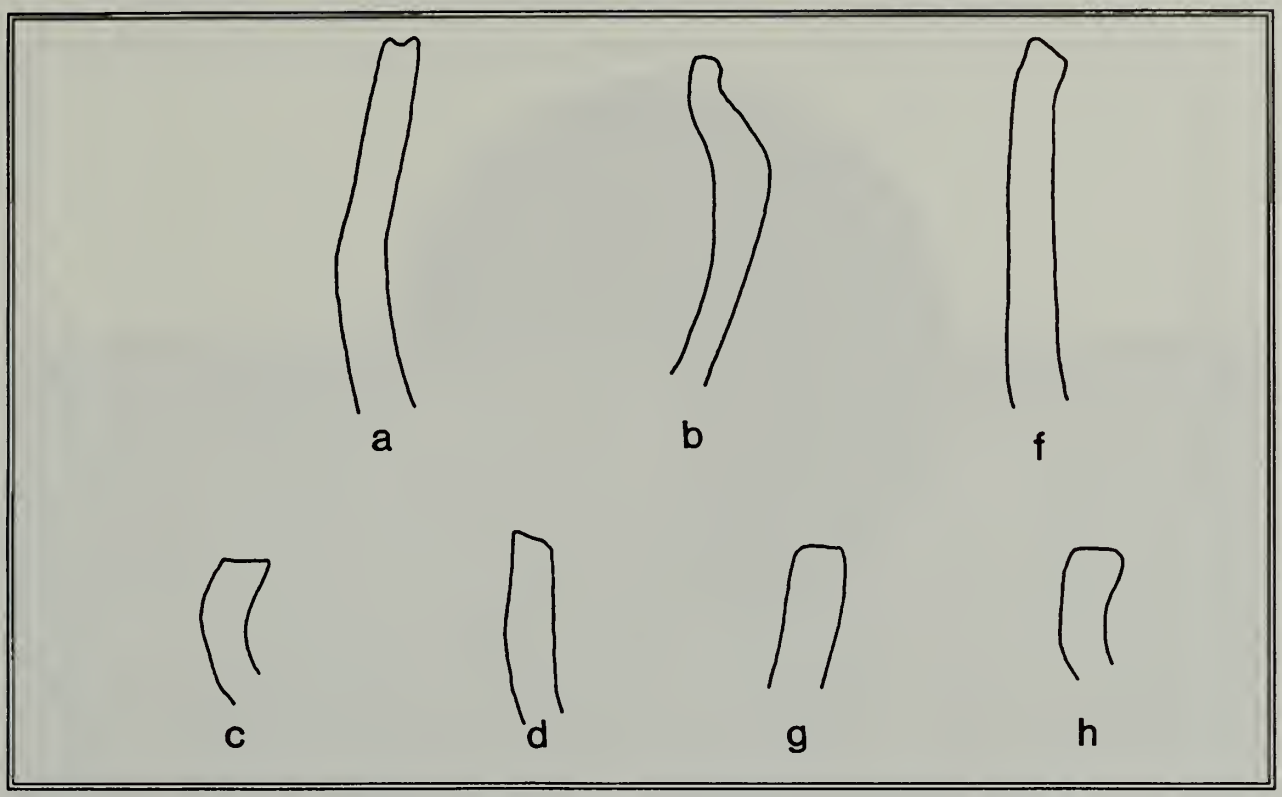


Figure 10-25. Rim sherd profiles of ceramics from Stratum 5. Interior surfaces are on the left. Letters correspond to sherds illustrated on Figure 10-24.

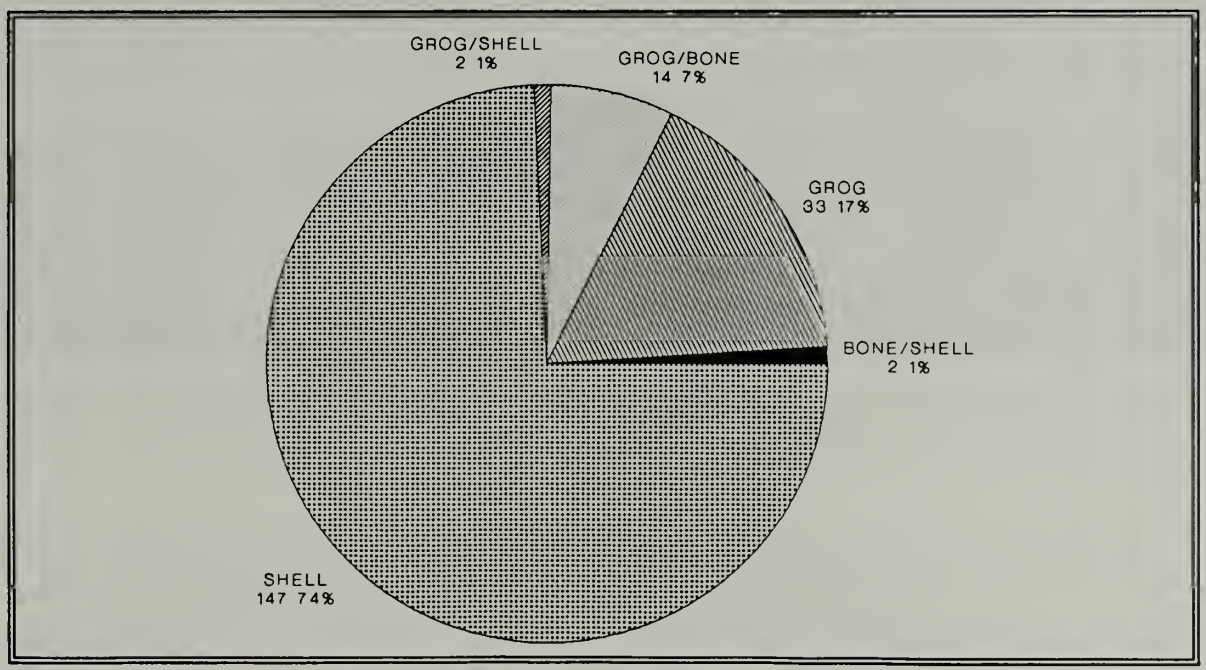


Figure 10-26. Frequency of ceramic temper groups for Stratum 5 midden.

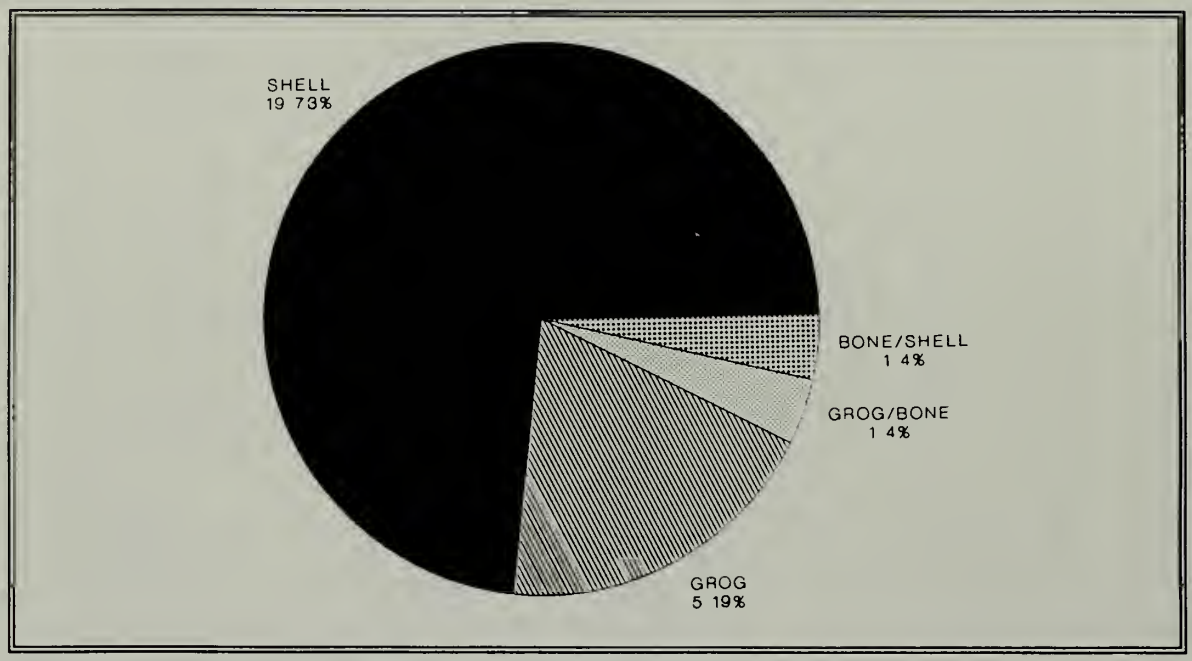


Figure 10-27. Frequency of ceramic temper groups for Stratum 5 living floor.

During the past decade it has become increasingly apparent that shell tempering technology developed in and around the Ozarks during the Woodland era (e.g., Lynott 1989; Schambach 1988). Evidence from the Rush site is concordant with this emerging point of view. In particular, the ceramic assemblage and other artifacts from the Feature 4 pit are especially noteworthy (Figure 10-28). The total artifact content of this pit includes examples of the two major diagnostic projectile point types for the midden component--Scallorn arrow points and Rice Side Notched dart points--in addition other chipped stone artifacts. The sherds incorporated into the pit fill, however, are overwhelmingly the shell tempered type Woodward Plain (Figure 10-29). Included in this assemblage are two fired pottery coils, both shell tempered. In addition to these artifacts, the pit fill also contained a layer of stacked mussel shells accompanied by a couple of handfuls of river snail shells. The combination of these items in Feature 4 can be interpreted as refuse from the production of and perhaps experimentation with shell tempered pottery at 3MR80-Area D. As discussed in Chapter 6, the infilling of this pit has been radiocarbon dated with the results of two assays at the 95 percent confidence level (two standard deviations) contained within the Woodland era. Further comment on the significance of this ceramic assemblage will be provided in the following chapter on intrasite trends.

The summaries of archeobotanical and zooarcheological remains from the midden component presented in Chapters 7 and 8, in combination with the artifact data summarized in this chapter, demonstrate that the kind of occupation creating this component was a year round, sedentary habitation representing the Late Holocene Sedentary adaptation type model. Middle to Late Woodland subsistence economies in the Ozarks

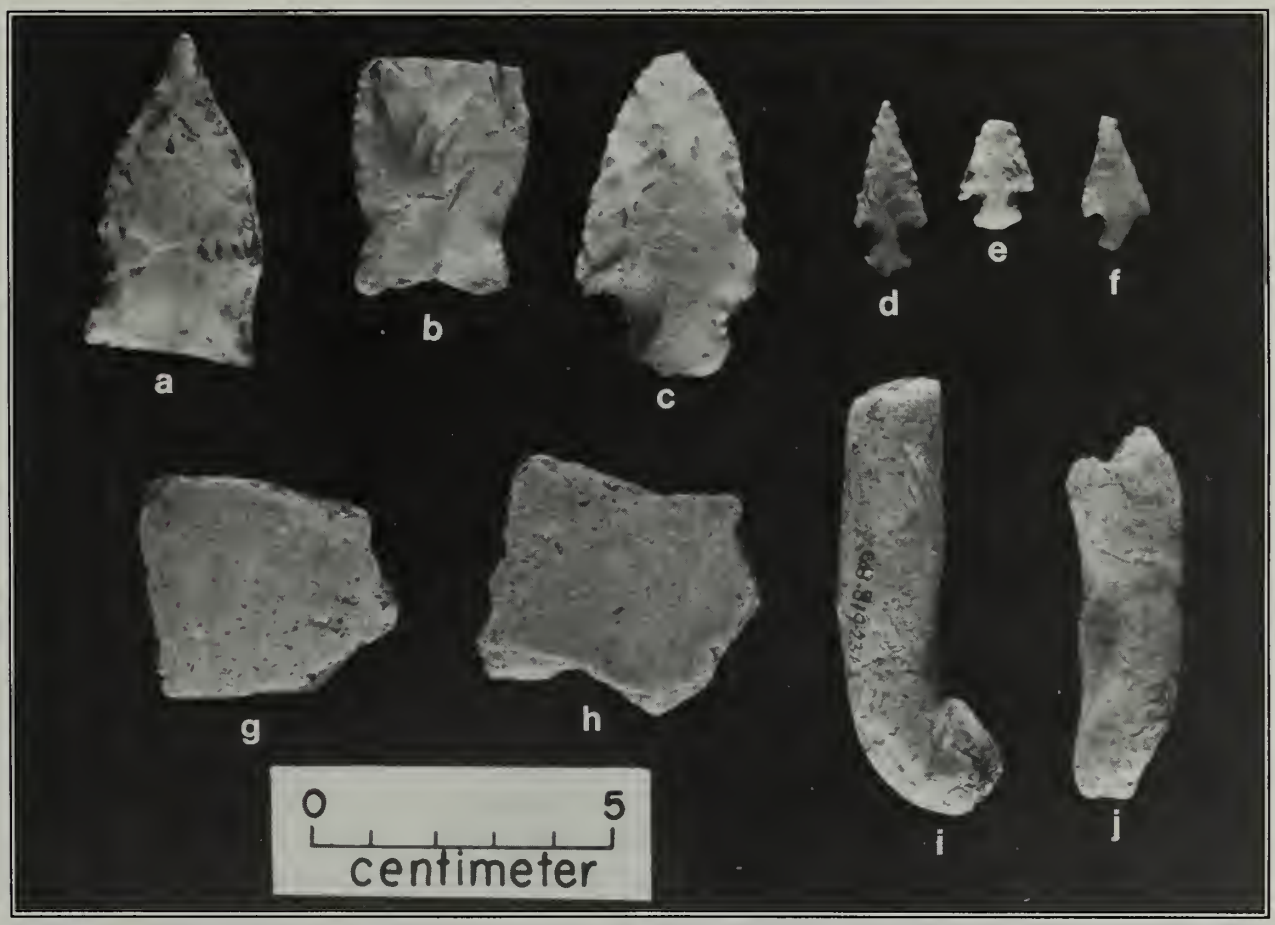


Figure 10-28. Artifacts from Feature 4: a-b = Rice Side Notched points; c = Stemmed point; d-f = Scallorn points; g-h = potsherds; i-j = pottery coils (AAS Neg. #894501).

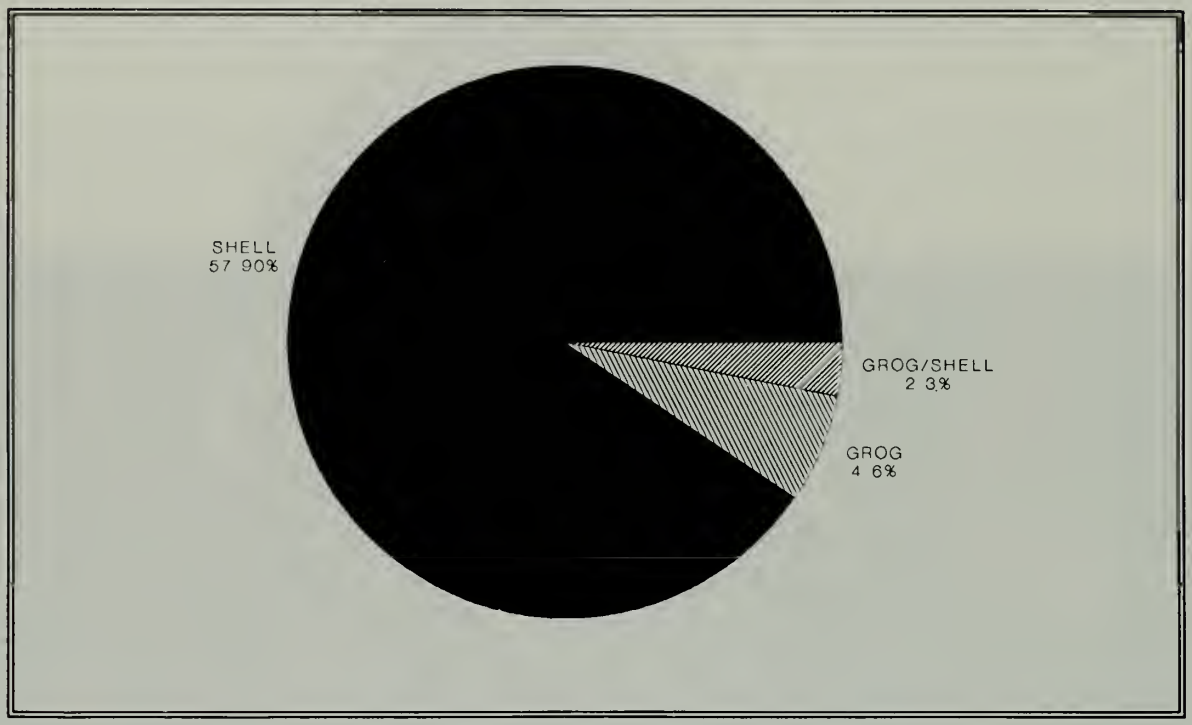


Figure 10-29. Frequency of ceramic temper groups for Stratum 5, Feature 4.

typically incorporated a broad spectrum utilization of a variety of hardwood forest plant and animal resources (Sabo et al. 1988:67-73). However, a gardening component had been added in the Rush locality that included the production of maize, squash/gourd, and other small grains and seeds. As Gayle Fritz points out in Chapter 7, the occurrence of maize in what appears to be a pre-AD 800 context at the Dirst site is highly significant. Due to the presently limited sample sizes, it is not possible to determine the overall organization of subsistence activities, nor is it possible at present to assess the relative importance of the various food resources that contributed to the subsistence of Woodland inhabitants of the Rush locality. The evidence in the faunal sample, indicating that the Rush site inhabitants attempted to cope with subsistence stresses by intensive utilization of deer, suggests that such analysis is needed. A fine-grained study of subsistence organization would certainly seem to be possible with further investigations at the site, and the results of this analysis would be of considerable importance to both local and regional perspectives.

The Middle to Late Woodland era was one in which revolutionary changes in cultural adaptations were underway across eastern North America, owing in part to major shifts in food production economies leading ultimately to the intensified maize production of the subsequent Mississippi period. For decades the "conventional wisdom" was that these revolutionary changes bypassed the Ozarks, where simpler, Archaic style lifeways were thought to persist. Research by contemporary scholars working in the Ozarks has gone far to rectify

this incorrect notion (e.g., Brown 1984a), but even so the evidence for Woodland subsistence changes available at 3MR80-Area D is unprecedented and warrants further careful and detailed investigation. Following the establishment of semisedentary adaptations by at least Early Woodland times, in which intensive harvesting of indigenous plant foods is indicated, Middle to Late Woodland period inhabitants of the Rush locality shifted to a year round occupation at the Dirst site where they participated in two cultural developments that would have widespread effects across eastern North America. The first was experimentation with shell tempered pottery manufacture. The second was a transformation of subsistence economy toward an increased investment in efforts to produce domesticated plant food, including the Mesoamerican cultigen, maize. In the context of these developments, it is perhaps significant that the inhabitants of the Dirst site intensified their participation in regional trade/exchange networks by gathering locally available quartz crystal for distribution elsewhere.

One final point that needs to be raised concerning the Stratum 5 midden component is the apparent lack of evidence for a continuation of occupation into Middle or Late Mississippian times. The lack of geomorphological evidence for erosion or deflation of the upper portion of Stratum 5 indicates that no additional sediments and cultural materials than those which we identified were once present in Area D. This observation leaves two alternative possibilities. One possibility is that a subsequent Mississippian occupation was centered on another part of the Dirst site or at another site in the Rush Development Area. In their earlier survey, SPEARS identified Mississippian artifacts in the midden deposit of Area A at the Dirst site, and Mississippian artifacts were also found at the Clabber Creek site (3MR52). A second possibility is that the main locus of subsequent Mississippian occupation shifted to another site altogether. Since a number of Mississippian sites have been identified in the locality (see Chapter 12), it does not appear that this area was abandoned altogether during late prehistoric times. Only further research will enable us to better understand the reasons for changes in settlement loci that evidently occurred during the latter centuries of the Mississippian era.

Intrasite Analysis: Time and Trends at 3MR80-Area D

GEORGE SABO III

Excavations at 3MR80-Area D isolated four and possibly five cultural components in stratified overbank sediments that originated from two paleochannels of the Buffalo River. A Dalton to Early Archaic component is contained in the Overbank 1 sediment (Stratum 1) deposited on the first terrace above the modern floodplain at a time when the Buffalo River occupied Paleochannel 2. Although the location of this paleochannel was not stable, the Buffalo River was much closer to Area D than it now is. At the time of the Dalton to Early Archaic occupation, flood episodes were sufficiently infrequent or of sufficiently reduced effect to permit development of a soil in the Overbank 1 sediments. Subsequently, Paleochannel 1 entrenched at the base of the present first terrace edge and remained in that location until it migrated to the modern channel position. The Buffalo River in Paleochannel 1 deposited the Overbank 2 sediment in Area D directly on top of the Overbank 1 sediment. Backhoe trenching into the lower portion of the Overbank 1 sediment (Stratum 2) exposed projectile points that date to the Early and Middle Archaic period, although our excavations were unable to locate additional diagnostic materials within these sediments. Artifacts dating to the Late Archaic, Early Woodland, and Middle Woodland to Early Mississippi periods were isolated in three stratigraphically separable subunits of the Overbank 2 sediment (i.e., Strata 3, 4 and 5). Prehistoric occupation of Area D appears to have ceased after the very intensive Middle Woodland to Early Mississippian habitation. As the Buffalo River migrated from Paleochannel 1 to its present position, conditions on Area D became conducive to the development of a second and more recent soil profile.

Together these components represent a series of occupations at the Dirst site dating from as early as 10,500 B.P. to as late as 840 B.P. The components recognized in Area D additionally may be related to other prehistoric components identified by previous research in the Rush locality. Several components are known or suspected in other areas of the Dirst site as a result of the 1986 testing program conducted by SPEARS (Spears et al. 1986). Area A of the site, for example, contains a midden deposit in which Woodland and Mississippian artifacts were found. It would be interesting to see how this midden compares with the one excavated in Area D. Area C also contains deep deposits with artifacts representing the Archaic and Woodland periods. A little further up Rush Creek, at the George Williams site (3MR157), SPEARS found artifacts dating to the Late Archaic and Woodland periods in cultural deposits that in places were over a meter deep. Across Rush Creek at 3MR51, test excavations by Sierzchula (1984) produced artifacts dating from the Early Archaic to Woodland periods. Finally, at the Clabber Creek site (3MR52), located at the eastern end of the Rush Development Area, SPEARS found intact cultural horizons extending to depths in excess of 2.6 m and

representing the Archaic, Woodland, and Mississippi periods. The limited testing that has been undertaken at these sites has not produced sufficient information as yet to determine the range of settlement types and activity profiles that may be represented. Even so, it seems likely that at least some of these components relate to simultaneous occupations, and therefore may represent various prehistoric communities that once inhabited this locality. If this were indeed the case, then the Rush Development Area holds the potential for truly innovative research concerning the structure and organization of prehistoric communities in the central Ozarks.

The impressive span of time represented by the components identified at 3MR80-Area D, the subject of this report, furthermore provides a context matched at only a few other sites for the study of prehistoric cultural developments in the Ozarks. In the remaining portion of this chapter, a brief intrasite analysis is presented that highlights some of the more noteworthy aspects of cultural change evidenced in the data produced by this project. It must be noted at the outset, however, that two limiting factors inhibit the extent to which interpretations can be made concerning aspects of cultural change. First, our excavations sampled primarily the Stratum 5 Middle Woodland to Early Mississippian component, and only a few units reached the more deeply buried strata. Not only are the material assemblages representing the earlier components much smaller, but preservation factors have eliminated some data sets, such as animal bone and botanical remains, from the lower strata. The material samples representing the various components, therefore, are not statistically comparable. A second problem with the available data is that there is a general lack of spatial information for every component, including the Stratum 5 midden component. A much larger number of test units than were excavated would be required to support an analysis of spatial distributions, an important dimension for the assessment of change in the archeological record.

With these cautions in mind, it is possible to address several aspects of cultural change that are evident in the stratified record of 3MR80-Area D. In the assessment that follows, the main emphasis centers on topics that concern broad patterns of cultural development in the Ozarks and in eastern North America. The conclusions presented below are offered as preliminary assessments of the data, and for each topic addressed there is the promise of further research in the Rush Development Area. Given the above mentioned limitations of our data, it would be unwise to attempt conclusive interpretations at the present time.

On the basis of the summaries presented in Chapters 9 and 10, it is possible to identify five phenomena that represent important aspects of cultural change represented at the Dirst site. These are: 1) changes in the use of the Dirst site as a settlement type within successive prehistoric settlement systems; 2) changes in preferences affecting the use of raw material sources for stone tool production; 3) changes in the importance of raw material types brought in to or sent out from the Dirst site, and implications concerning the organization of prehistoric communities in the Rush locality and interaction with more distant communities; 4) the evolution of pottery making technology; and 5) development of subsistence adaptations incorporating domesticated plant foods.

Settlement Types

Although it is not possible to make a strictly controlled comparison of settlement data for each prehistoric occupation of 3MR80-Area D, there is some evidence suggesting that different settlement types are represented for each of the identified components. One of the excavation units that reached Stratum 1b, N995/E998, produced a fairly small sample of artifacts from the levels excavated into the paleosol, compared to the artifact "catch" from other cultural deposits within Area D. This admittedly slim evidence is consistent with an interpretation of an impermanent, perhaps seasonal occupation of the site by Dalton and Early Archaic groups. It would be unwise to push the notion of impermanent settlement too far, however, in view of Dan Morse's identification of Dalton base camps in eastern Arkansas (e.g., Morse and Morse 1983). Further excavations into the paleosol (Stratum 1) to recover a larger sample of artifacts should provide the necessary data to determine if a base camp activity profile is represented at this site.

The Late Archaic component is represented by a limited artifact inventory also suggesting a temporary occupation of the site. It is not possible to determine whether a base camp or special purpose occupation is represented. Stone tool making was definitely one important task associated with this occupation, but the presence of scrapers, a graver, and a core tool chopper indicates a more diversified activity profile and implies the presence of one or more family groups performing a limited number of maintenance and/or manufacturing tasks.

The Early Woodland component is represented by a somewhat wider range of functional artifact types that includes woodworking tools. The arc of postmolds identified in Stratum 4 in all likelihood represents a shelter of some sort. This is clearly the kind of evidence we expect to find for a base camp occupation. The botanical remains recovered from Stratum 4, if they are indeed associated with the Early Woodland component and not intrusive from the overlying stratum, are a further indication that this base camp occupation of Area D was part of a semi-sedentary settlement pattern that produced disturbed anthropogenic habitats conducive to the development of symbiotic relationships between human groups and adventitious weedy plants producing large numbers of oily and starchy seeds suitable for human consumption (cf. Rindos 1980; Smith 1985). The advent of these conditions corresponded to important changes in settlement patterns that would have far reaching consequences for prehistoric populations throughout eastern North America. The documentation of these settlement pattern changes at the Dirst site should help lay to rest misperceptions that prehistoric cultural trajectories in the Ozarks were substantially different than those evident in adjacent regions.

The Middle Woodland to Early Mississippian occupation of Area D, as noted previously, represents year round occupation of the site. Although a positive identification of structures associated with this component has not been made, evidence suggesting the existence of such structures was found, and additionally, artifact and faunal evidence are also indicative of a year round habitation. Whether this occupation was a base camp, a village, or some other residential type cannot presently be determined. However, the depth and content of the midden associated with this component make it clear that this occupation was considerably more intensive than anything that had previously been witnessed at the site. This evidence for sedentary settlement, possibly

associated with an intensification of domesticated plant production, represents another important transition in the development of subsistence settlement systems and associated prehistoric cultural landscapes within the central Ozarks.

A more detailed assessment of each settlement type represented at the Dirst site, along with further information concerning the larger settlement systems of which those occupations were a part, would greatly enhance our understanding of the development of prehistoric cultural landscapes in the central Ozarks. Information on the group size associated with each of these components would provide additional insights into the structure and distribution of prehistoric population aggregates in the region.

Lithic Raw Material Selection

As noted in previous discussions of lithic resource utilization, there were apparently some changes through time in preferences for stoneworking materials. Particularly evident are changes in preferences for cherts from the Boone, St. Joe, and Reeds Spring formations. These all are chert types that occur abundantly in local outcrops but which vary considerably in quality. The following discussion is based on the assumption that differences in the relative amounts of these materials in the sampled strata of Area D are not merely the result of biases in our sampling strategy. The possibility of a problematic sample cannot presently be discounted.

In Strata 1 and 2 the Boone, St. Joe, and Reeds Spring cherts occur in approximately the same amounts as measured by weight. If we assume equal access to all three chert types, there does not seem to have been any particular preference in the choice of locally available stone during Dalton through Middle Archaic times. In the Late Archaic component, there is a slight predominance of St. Joe cherts over Boone and Reeds Spring cherts, both of which are represented in approximately equal proportions. In the Early Woodland component, the Boone cherts comprise the largest category by weight, with the St. Joe and Reeds Spring cherts equally represented as the less preferred choices. The predominance of Boone cherts continues in the Middle Woodland to Early Mississippian component, but St. Joe cherts seem to be favored as a second choice over the less utilized Reeds Spring material.

An explanation for these changing preferences is difficult to find. As mentioned above, there is some variation in the stoneworking properties of these materials. The St. Joe and Reeds Spring cherts appear to possess superior flaking qualities. Why the Boone cherts would be preferred over the other two cherts is, therefore, a mystery, unless the grainier, more resilient Boone cherts were preferred for certain categories of tasks. This possibility could be experimentally tested. The use of St. Joe and Reeds Spring cherts as trade materials is another possibility that would account for shifting preferences for local utilization. However, this hypothesis would have to be tested against a regional database of raw material frequencies that does not now exist. A third possibility is that the Boone cherts were simply more easily acquired from nearby sources. The lithic assemblages associated with all of the components identified in Area D suggests that local gathering of chert cobbles and pebbles from alluvial and/or colluvial deposits, rather than quarrying at outcrops, provided

most of the raw material used at the Dirst site for the manufacture of stone tools. It may be that Boone cherts predominate in local gravel deposits, in which case preferences for the St. Joe and Reeds Spring cherts would be indicated for the Dalton through Late Archaic occupations at the Dirst site but not the subsequent occupations.

Additional explanations for the distribution of lithic raw materials observed in the various components identified at the Dirst site can be easily imagined. Deciding which of these hypotheses best supports the weight of evidence will not be as easy. To the extent that potential explanations can be refined and tested, significant information on prehistoric use of the Ozark landscape and its natural resources will be provided. In the following chapter of this report, further consideration of this topic is given in a GIS analysis of travel costs to various bedrock sources from the Dirst site.

Trade/Exchange Patterns Involving Lithic Raw Materials

Another feature of the distribution of lithic raw materials at the Dirst site is the presence in some of these components of small amounts of nonlocal stone. This observation may reflect the participation of the Dirst site inhabitants in trade or exchange networks connecting them to more distant communities (cf. Gould 1978, 1980). Such networks are often found among mobile foraging populations, because they provide for several things in addition to a source for the acquisition of nonlocal materials. Through such networks allies or marriage partners might be found, information concerning the distribution of subsistence resources and environmental conditions affecting those resources can be rapidly exchanged, and population redistributions can be facilitated. Among more complex, sedentary societies, trade and exchange networks provide these advantages as well others, such as the use of these networks to demarcate territorial boundaries, and reliance upon favorably endowed trade partners as a source of food supplies during years when crop yields or other important resources are diminished.

Very little nonlocal stone was found in the lithic assemblages derived from Strata 1 and 2, in which a Dalton to Early Archaic component was identified (Stratum 1) and an Early to Middle Archaic component was postulated (Stratum 2). However, one of the Graham Cave Side Notched points found in Stratum 1 was made of nonlocal quartzite. This observation in addition to the very limited size of the lithic assemblages from these strata suggests that it is premature to speculate on the extent of participation in nonlocal trade/exchange networks on the part of the earliest inhabitants at the Dirst site, even though such participation does seem to be indicated.

It is perhaps more noteworthy that the larger assemblage of lithics derived from Stratum 3 and associated with the Late Archaic component also contains very little in the way of nonlocal raw materials. We seem to be on safer ground suggesting that these inhabitants of the Dirst site were involved little or perhaps not at all in trade/exchange networks connecting them with more distant populations.

In contrast, the Early Woodland and the Middle Woodland to Early Mississippian inhabitants of the Dirst site evidently valued participation in such networks, judging from the consistently larger amounts of nonlocal stone represented in the lithic assemblages associated with those components. This participation may even have intensified during the Middle Woodland to Early Mississippian occupation of this site. In the materials attributed to that component, small amounts of quartz crystal debitage occur for the first time. Quartz crystal can be acquired locally, and it is possible that the Dirst site inhabitants were gathering and preparing this material for trading purposes. Although it is clearly premature to suggest a direction for such trade, it is perhaps significant that at this time Plum Bayou culture populations centered in the Arkansas River Valley around the Toltec site were consumers of this material for a portion of their stone tool inventory (Rolingson 1982), as were inhabitants of the central Mississippi Valley (Morse and Morse 1983).

Other commodities that might have been traded against exotic stone, either going out of or coming into the Rush locality, cannot be ascertained at present. It is important to note, however, that the social relationships made possible by the existence of these trade/exchange networks were often of considerably greater importance to participants that the actual commodities exchanged. Moreover, trade/exchange networks, often initially formed under more egalitarian circumstances, provide social institutions that can be subjected to manipulation and control by elite individuals or classes as more complex forms of social organization develop. In view of the evidence at the Dirst site for increasing cultural complexity through time, it might be possible with further research to investigate the processes by which trade/exchange networks were transformed from egalitarian operation to control by elites.

The Evolution of Pottery Making Technology

Ceramics were included in the assemblages attributed to two of the components identified in Area D. The attributes of these ceramics and their stratigraphic/chronological associations are highly significant to contemporary reconstructions of Ozark culture history.

The Early Woodland component isolated in Stratum 4 contained six sherds. Two of these sherds, both shell tempered, were found at the top of the stratum and may have been displaced from the overlying midden stratum. The remaining four sherds, all grog tempered, were found well within this stratum and appear to be associated with the other artifacts attributed to this component, which include Stone Square Stemmed, Afton, and Langtry projectile points. The four grog tempered sherds are all fragments from the bodies of thick walled vessels, so little else can be said about them except that they seem to represent the type Williams Plain.

Williams Plain is the name given to grog tempered, undecorated, unpolished pottery found on Woodland period Fourche Maline culture sites in the Red River and Ouachita Mountain regions of southwest Arkansas and eastern Oklahoma (Bell 1953; Schambach 1982). Vessels typically are flower pot shaped and have thick walls and round or square flat bases. The earliest radiocarbon dated appearance of Williams Plain pottery is at the Wann site in Oklahoma, where it was found in a context radiocarbon dated to 1,845 +/- 65 B.P. (UGa-2073; Galm and Flynn 1978:88). According to Schambach (1982), Williams Plain has its earliest appearance in

the Red River region of southwest Arkansas, from which location it gradually spread to the north. This type occurs at the Spiro site in Evans and Harlan phase contexts (Brown 1976) and, further down the Arkansas River, Williams Plain pottery is a major constituent of the Fourche Maline-like Gober complex in western Arkansas (Hoffman et al. 1977). This pottery type also occurs in Middle and Late Woodland assemblages in the Ozarks region of northeast Oklahoma, southwest Missouri, and northwest Arkansas (Brown 1984a).

If the occurrence of Williams Plain pottery in an Early Woodland context at the Dirst site has been correctly established, then the introduction of ceramics in the central Ozarks took place at a somewhat earlier time than has been previously suspected (Brown 1984a:26).

Excavations into Stratum 5 produced a sample of 27 ceramic sherds from the living floor, 63 sherds from the large pit feature (Feature 4) that originated at the living floor, and 198 sherds from the midden. Of this total, 77 percent are shell tempered. The majority of rim and base sherds are representative of the type Woodward Plain (Baerreis and Freeman 1959). The attributes of this pottery type are similar to those of Williams Plain, except that shell tempering is characteristic of Woodward Plain. This type appears in the Spiro phase of eastern Oklahoma and western Arkansas, in the Neosho phase of northeast Oklahoma and northwest Arkansas, and in the Loftin phase of southwest Missouri (Chapman 1980; Brown 1984a).

The occurrence of Woodward Plain pottery at the Dirst site in Middle and Late Woodland contexts supports conclusions that others have reached concerning a pre-Mississippian development of shell tempered pottery in the Ozarks (e.g., Schambach 1988; Lynott 1989). What may be particularly significant about the Dirst site assemblage is that ceramics and associated materials found in the Feature 4 pit are suggestive of experimentation with shell tempering: in addition to carefully placed stacks of mussel and river snail shells in the pit fill, numerous shell tempered sherds were found along with two fired, shell tempered pottery "snakes."

Although the sherd assemblage is too small and fragmentary to permit reconstruction of vessel forms and volumes, the association of shell tempered pottery with this component, interpreted as a year round habitation, and the dating of the Feature 4 fill to Middle Woodland times, is important in and of itself. In combination with the tiny assemblage of grog tempered pottery from Stratum 4 attributed to an Early Woodland time period, the Dirst site ceramic assemblage may be indicative of larger trends in the evolution of pottery making technology in the Ozarks.

Recently, Brown (1989) has argued in favor of an economic explanation for the adoption of ancient pottery technology, and his ideas on this subject may have a useful application in the Ozarks. In his model, the key variables influencing the adoption of pottery--as an alternative to other types of containers--are demands for water tight, fire resistant containers, and major constraints in meeting those demands. Alternative sources of supply for suitable containers, and time and situational factors affecting production of these alternative forms, are the primary variables that contribute to constraints in fulfilling the demand for containers.

The earliest pottery types in eastern North America, which tend to be thick, crude, and poorly fired, probably were intended for hot stone boiling rather than open flame boiling. Since vessels used for hot stone boiling were subjected to minimal thermal stresses, these early vessels were probably well suited to the purposes for which they were intended. With the advent of cereal grain cooking, however, prolonged boiling was required to break down the grain into an edible starch, and thus a more durable vessel was required that could withstand the thermal shock of cooking over a direct flame. Thus, with an increase in the variety of seed crops and other plant foods harvested by late prehistoric Indians in eastern North America, coupled with additional requirements for different kinds of vessels for storing, processing, and serving or presenting food products, a significant increase in the demand for containers resulted.

According to Brown, pottery making can be a viable solution to such increases in the demand for large numbers of containers because it confers significant time budgeting advantages for groups whose residence patterns are at least seasonally sedentary. The steps required for the production of pottery, which involve the gathering and processing of clay and the shaping, drying, and firing of vessels, are time consuming but they can be easily integrated with other household activities in sedentary situations. That is, among sedentary or even semi-sedentary groups, there are typically a number of individuals (usually women) whose daily activity patterns are centered around a fixed settlement. Since there is usually some flexibility in the time budgeting of these activity patterns, additional tasks can often be worked in. Once begun, pottery making must be carried through to completion, but the steps in the production process can be separated and fitted into available time slots. Additionally, base camp settlements can be more easily located near suitable clay sources than near suitable sources of stone for the production of containers, and vegetal materials used to make containers, such as bark, grasses, and reeds, are often available for only a few weeks during the year. In some situations, pottery making as an element of a domestic routine centered at a fixed settlement may thus involve fewer labor costs than the production of alternative types of containers. Moreover, pottery production provides for a certain economy of scale in that the labor cost required to produce an individual pot declines significantly with the number of pots that can be made simultaneously. In other words, it is cheaper to produce several pots than it is to carve several stone bowls or to make several woven basketry containers.

In summary, the adoption of pottery, according to Brown, can be viewed as an economic process operating under conditions in which the need for water tight, fire resistant containers produces a greater demand than existing alternative sources of supply can furnish. In eastern North America, these conditions arose when small seeds and nuts, and particularly cereal grains, were adopted as food sources requiring extensive processing and prolonged boiling. Sedentary or at least semi-sedentary settlement also seems to be a prerequisite for the adoption of pottery, since it is specifically in the context of a domestic activity pattern tied to a permanent settlement that the labor costs of pottery can be brought down to a level at which the demand for large numbers of containers can be economically satisfied.

The appearance of pottery as a significant element of material culture at the Dirst site suggests that this combination of factors had developed in the central Ozarks at least by Middle Woodland times, and possibly by Early Woodland times.

Adaptations to Domestic Plant Production

Perhaps the most far reaching cultural change indicated in the archeological record at the Dirst site is the one by which hunting and gathering economies were transformed into subsistence adaptations incorporating the production of domesticated plant crops. The adoption of maize and other crops was of great consequence to late prehistoric populations throughout eastern North America. At the Dirst site, evidence is preserved in stratified, radiocarbon dated contexts indicating that prehistoric Ozark populations participated in several important developmental stages leading ultimately to domesticated plant production involving both indigenous and tropical cultigens. This evidence is admittedly very limited in quantity, due in all likelihood to problems in data recovery techniques rather than a lack of archeobotanical materials preserved in cultural deposits at the site. The significance of this evidence, however, should not be underestimated.

In the Late Archaic assemblage derived from Stratum 3, a single chenopodium seed was identified in addition to acorn and hickory nut fragments. The Early Woodland assemblage derived from Stratum 4 contained small numbers of knotweed, bedstraw, chenopod, and amaranth seeds. An arc of postmolds also attributed to this component suggests that the disturbed soil conditions preferred by these adventitious seed bearing plants were present at the Dirst site during this period. The likely adoption of pottery during Early Woodland times, which also seems to be correlated both with sedentary settlement and an increase in the utilization of small seed and nut crops, is further evidence corroborating a shift in the direction of domesticated plant production.

The Middle Woodland to Early Mississippian component identified in Stratum 5 produced the largest sample of archeobotanical remains. Little barley and other small seeds were the most abundant plant species represented. Squash/gourd fragments were also preserved in the midden, and a small amount of maize was recovered, some of which came from the Feature 4 pit radiocarbon dated to Middle Woodland times. The production of these domesticated plant species had evidently been incorporated as one element of a year round set of activities associated with this occupation of the Dirst site. It is presently not possible to measure the relative importance of domesticated plant production in the Rush locality, but additional elements of the local subsistence economy included the harvesting of seasonally available nuts and fruits, the intensive predation of deer, elk, and other animal species, and the acquisition of aquatic resources including fish, turtles, and mussels. In short, a broad spectrum subsistence economy in which domesticated plant production was one component is indicated.

The significance of the archeobotanical assemblage is enhanced by the fact that these specimens can be evaluated in conjunction with several other sources of information that have only recently become available. The preservation of impressive quantities of archeobotanical remains in dry Ozark rockshelters has been well known for decades, but it is only recently that these remains have been analyzed in the larger context of eastern North American paleoethnobotany through the studies of Gayle Fritz (1984, 1986; Fritz and Smith 1988). Fritz's studies in addition to other evidence (e.g., Kay et al. 1980; Smith 1985) indicate that Ozark populations began to harvest indigenous seed crops in addition to squash and gourd by Late Archaic times, if not earlier.

There followed a period of more intensive utilization and domestication of indigenous seed bearing plant species during the Woodland period, at which time maize was introduced but grown only in limited quantities. After A.D. 1200, maize became the dominant crop species in subsistence adaptations that also included the production of significant amounts of squash and common beans (cf. Voigt 1989).

This scenario has been recently challenged by bioarcheologists (e.g., Burnett 1989), who point out that late prehistoric skeletal remains from the Ozarks do not show evidence of dietary dependence upon domesticated plants, particularly maize or other starchy carbohydrates. At the most, a mixed subsistence economy in which domesticated plants played only a minor role seems to be indicated. Until additional studies of human skeletal remains representing late prehistoric Ozark populations can be undertaken, the issue of adaptations to domesticated plant production in the Ozarks will probably not be resolved to everybody's satisfaction. On the other hand, the evidence from the Dirst site, limited as it is, does appear to reflect larger cultural processes that are evident throughout eastern North America.

In a recent review, Smith (1989) argued for the recognition of eastern North America as an independent center of plant domestication. Indigenous domesticants identified by Smith include squash, sumpweed or marshelder, sunflower, and chenopod. The domestication of these plants is attributed to co-evolutionary relationships between humans and adventitious plant species preferring disturbed anthropogenic habitats (cf. Rindos 1980). These relationships appear to have developed in several localities by the second millennium B.C. The resulting symbiotic relationships between humans and seed bearing plants gave rise to the emergence between 250 B.C. and A.D. 200 of food production economies based on the above mentioned indigenous domesticants. The Mesoamerican domesticant maize was introduced by A.D. 200, but for several hundred years it remained a minor cultigen, perhaps used mainly in ceremonial or high status social contexts. Between A.D. 800 and 1,100, however, a shift to maize based agriculture is witnessed across eastern North America, and this economic adaptation is considered by Smith to have been an important element in the development of historic Native American cultures.

The evidence summarized here concerning changing settlement patterns, participation in external trade/exchange networks, the adoption of pottery making technology, and the advent of domesticated plant production at the Dirst site strongly suggests that the prehistoric inhabitations of the Rush locality were participants in larger events that wrought significant cultural transformations across eastern North America. It has become increasingly clear in recent years that the incorporation of domesticated plants within prehistoric subsistence economies was not a single event, but rather the culmination of a series of convergent evolutionary trends that developed over millennia within past human ecosystems (Rindos 1984). In eastern North America, events leading to the development of agricultural economies involved both the domestication of indigenous plant species and the adoption of tropical cultigens that had been domesticated centuries earlier in Mesoamerica. The identification of indigenous and tropical cultigens at the Dirst site is highly significant with respect to contemporary reconstructions of Ozark prehistory. It is even more noteworthy that the Dirst site may indeed hold additional clues concerning the processes by which these revolutionary prehistoric cultural transformations took hold in the central Ozarks.

Adaptation Types and the Prehistory of the Dirst Site

The conclusions presented above concerning the measurement of prehistoric time and trends in the central Ozarks from the perspective of the Dirst site permit a final set of comments to be made concerning the adaptation type models we have used to summarize the prehistoric cultural sequence in this region.

The Dalton to Early Archaic occupation identified in Stratum 1 represents a component of the Foragers of the Late Pleistocene-Early Holocene Transition adaptation type. Geomorphological evidence summarized in Chapter 5 of this report indicates that characteristics of the Buffalo River and the local landscape were substantially different at the time of that occupation than today, but that a trend toward modern environmental conditions had already commenced. The presence of a paleosol in Stratum 1 indicates that the occupied landform was stable and was not prone to frequent flooding. The limited artifact data representing this occupation suggests a mobile, seasonally scheduled adaptation to a woodland environment. The presence of limited amounts of exotic raw materials in the artifact assemblage is also consistent with the notion that these early populations were both locally mobile and were divided into small groups that maintained contact with one another across larger territories. The stratigraphic context of this component in a buried stratum is significant, and suggests the possibility that with further excavation additional data concerning this poorly known adaptation type can be derived.

A component of the Foragers of the Early to Middle Holocene adaptation type is suspected in Stratum 2. Little can be said about the local manifestation of this adaptation type at the present. However, the potential seems to exist at this site for testing hypotheses concerning the responses of Early and Middle Archaic populations to the local effects of large scale, Hysithermal climatic changes.

Components of the Late Holocene Semi-Sedentary and Late Holocene Sedentary adaptation types are represented in Strata 3, 4 and 5 in Area D of the Dirst site. These components represent an occupational continuum that reflects a transition in the Ozarks from the semi-sedentary to the sedentary adaptation type. Although we are unable as yet to specify the processes involved in this transition, several elements contributing to this transformation can be identified.

To begin with, it appears that in general the Late Archaic to Early Mississippi time period that is of concern here was one in which environmental stability prevailed. On a regional scale, available paleoenvironmental evidence suggests that only minor deviations occurred around a mean comparable to modern conditions (Sabo et al. 1988). In the Rush locality, geomorphological evidence summarized in this report indicates that the Buffalo River had achieved a regime in which flood depositions were uniform through time and perhaps largely predictable in their occurrence. The local landscape and its resources presumably underwent no pronounced changes during this period, although there is certainly a need for more direct evidence to support this contention.

Comparison of archeological data preserved in Strata 3, 4, and 5 indicate that the occupants of the Dirst site responsible for these materials, in addition to becoming increasingly sedentary, adopted several other changes that affected their adaptations and lifeways. By at least Middle Woodland times, if not earlier, pottery making technology had been incorporated into the material production repertoire, and in that context the innovation of shell tempering was quickly added. Indigenous domesticated seed bearing plants as well as the tropical cultigens maize and squash/gourd were incorporated into the subsistence economy. The question of whether the inhabitants of the Rush locality participated in the actual domestication of indigenous seed bearing plants remains open. Nonetheless, these plant species evidently were adopted as food sources when disturbed anthropogenic habitats provided the appropriate conditions for the emergence of symbiotic relationships with human populations. As noted previously, across eastern North America the adoption of seeds and grains as food sources and the advent of pottery making technology seem to have gone hand in hand with, and indeed may have been made possible by, the transition to sedentary settlement. The prehistoric inhabitants of the Ozarks were not excluded from this general pattern.

One factor that may have been peculiar to the Rush locality in this transition from semi-sedentary to sedentary lifeways was the intensive predation of deer and elk, and the extensive utilization of virtually every calorie of food energy available from these species, that is evidenced in the zooarcheological assemblage associated with the Middle Woodland to Early Mississippian component. This intensive predation may have been due to cultural preferences alone, or the quest for animal protein may have been necessitated by a large number of people congregated at the Dirst site or in the Rush locality during this period of occupation. Intensive hunting could also have been motivated by the use of animal products as commodities for trade or exchange with other populations. Only through additional investigation of the Rush locality will we be able to critically evaluate these alternative hypotheses.

Turning to more encompassing explanations for the shift from mobile to semi-sedentary and sedentary adaptations in the Ozarks, we may briefly consider three alternative scenarios. The first involves external natural environmental stimuli impinging upon local human ecosystems; the second involves external cultural factors impinging upon local human ecosystems; and the third involves adaptive shifts brought about by developments within the local human ecosystem.

As indicated previously, the Late Archaic to Early Mississippian time period was marked by overall environmental stability in the central Ozarks. At the present time we have no evidence that significant ecological shifts were produced by large scale changes in climate or other environmental factors. It is true that climatic variations probably affected available soil moisture in many areas during the Mississippi period, but it is unlikely that this would have had a substantial impact upon the broad spectrum subsistence economies of late prehistoric Ozark populations. Therefore, we may tentatively rule out external environmental factors as a significant element of evolutionary processes giving rise to sedentary adaptations in this region. Conversely, environmental stability might have contributed positively to this transition.

The evidence at the Dirst site for an increase in the participation of local populations in trade/exchange networks connecting them with more distantly located populations is consistent with the notion that the shift to sedentism in this region might have been influenced by extra-regional sociocultural factors. As will be discussed in Chapter 13, many of these same cultural changes were developing at the same time in regions directly adjacent to the central Ozarks. Contemporaneous regional transitions throughout eastern North America towards increasing sedentism, the development of food producing economies, and associated increases in levels of sociocultural complexity, may indeed have been stimulated, at least in part, by similar but slightly earlier developments that took place in the American Bottoms region of the central Mississippi Valley. Although it has been demonstrated that Indian populations in the Ozarks participated in these broad patterns of prehistoric cultural change, we have yet to identify any specific sociocultural stimuli that may have extended into this region, and we have yet to determine what influences those stimuli might have produced.

Internal cultural changes were identified as a third proximate factor potentially involved in the shift to sedentary adaptations in the Ozarks. At the present time we simply do not have enough evidence from the Dirst site, nor indeed from anywhere in the Ozarks, to confidently separate internally generated trends from those stimulated by external factors. On the other hand, it would be quite extraordinary if there were a total lack of internal factors influencing the trajectory of prehistoric cultural developments in the Ozark region. The previously discussed intensive predation of deer and elk may well turn out to be a reflection of some internal cultural factor at work within the cultural system developing in the Rush locality. Another local factor that may have played a significant role in the emergence of sedentary adaptations would be the development of subsistence settlement strategies that permit efficient access to resources that occur in a seasonally shifting pattern across the highly variegated landscape of the central Ozarks. A GIS analysis of the Rush site "catchment" presented in the following chapter provides some interesting conclusions that pertain to this possibility. Finally, local demographic factors might also have been influential, but at present there are no data available concerning prehistoric demographic profiles in the central Ozarks.

To conclude the foregoing discussion, the most important thing that can be said is that the results of our work at the Dirst site indicate that prehistoric populations inhabiting the central Ozarks during the Woodland era developed a sedentary adaptation based on a broad spectrum subsistence economy in which domesticated plant production was one element. This cultural system is distinctive, due in part to its indigenous origin in the Ozark Highlands, yet it demonstrates that these societies were prominent participants in some of the most far reaching cultural developments that took place in eastern North America. Moreover, the deeply stratified and rich cultural record preserved at the Dirst site has been shown to contain abundant evidence that may help us reconstruct some of the more significant events and processes that were involved in these important evolutionary developments.

To whatever extent we may ultimately be able to explain the transition from mobile to sedentary adaptations in the Rush locality, it remains to address the issue of subsequent Mississippian developments in the region. As noted previously, there is a lack of evidence at 3MR80-Area D for occupation subsequent to the Early Mississippi period. The most likely explanation for this, as suggested in Chapter 10, is that the locus of

intensive settlement subsequent to the Early Mississippian occupation of Area D shifted to another part of the Dirst site or to another site in the Rush locality. The presence of other Mississippian sites in this region indicates that this area was not abandoned during later Mississippian times.

The reason we need to eventually resolve the issue of what happened during the Mississippi period in the Rush locality is that this information will contribute significantly to the picture of Mississippian cultural developments in the central Ozarks that is gradually coming into focus. Evidence from a number of sites in this region, many of them located in the Buffalo River Valley, suggests the development of a distinctive regional variant of Mississippian culture.

At the Elk Track site (3NW205), located at the Erbie Campground along the Buffalo National River, a Mississippian component was recently identified that provides evidence of a sedentary adaptation based on a mixed subsistence economy incorporating hunting, gathering, and domesticated plant production (Lafferty et al. 1988b). A noteworthy feature of this site is a post mold pattern representing a rectangular Mississippian house measuring approximately 6x7 m, with several associated pit features. Four radiocarbon assays from the house were averaged to provide an age of 1,324 +/- 47 A.D. The single house structure and the small size of the site (ca. 2 ha) suggest that this occupation was by a relatively small group.

The artifact assemblage from this site included several arrowpoint types (Scallorn, Madison, Cahokia Side-Notched, Nodena, Ashley, Bonham, and Maud), a number of dart points which may or may not have been associated with the Mississippian occupation of the site, and undecorated shell tempered pottery. Pottery vessels were mainly jars with outflaring rims and straight-sided bowls. The archeobotanical assemblage from this component indicates seasonal harvesting of nuts, fruits, and seeds. Little barley, chenopod, marsh elder, sunflower, squash, maize, beans, and possibly tobacco and amaranth, were also cultivated. Deer provided the main source of animal protein for the Mississippian residents of the Elk Track site. Other animal species used as food resources included a variety of small mammals, birds, fish, turtles, and mussels.

At the upper end of the Buffalo River Valley, in the Boxley Valley locality, two additional sites have produced important information on Mississippian adaptations. Three large pit features salvaged from an eroding cut bank of the Buffalo River at 3NW539 contained undecorated shell tempered pottery, arrowpoints, several sandstone grinding basins, and basketry fragments. Animal bone representing deer, small mammal, birds, turtle, and mussels were identified in the fill from these pits, and fragments of corn cobs were also noted. At least one of the pits had been used as an earth oven before it became a receptacle for habitation refuse (Limp 1989b).

At the Luallen site (3NW662), test excavations produced evidence of Woodland and Mississippian occupations (Spears 1989). Midden sediments were associated with both components, and the Mississippian midden deposit contained two possible post molds. Mechanical scraping also exposed a cluster of refuse filled pits dug into an old gravel bar. Artifacts representing the Mississippian occupation include several arrowpoint types (Reed, Rockwall, Sequoyah, Shetley, and two Nodena-like specimens) and undecorated shell tempered

pottery. Rim sherds profiles represent vessels with straight to slightly everted rims. Two base sherds were from flat bottom vessels.

Although specialized analyses of the faunal and floral remains from this site have not been completed, preliminary observations suggest that a mixed subsistence economy is reflected. The presence of the midden and associated features suggest sedentary occupation during the Woodland and Mississippi periods.

One other Mississippian site in the Buffalo River Valley that deserves mention here is Cobb Cave (3NW6), excavated in 1931 by the University of Arkansas Museum. As its name implies, large numbers of prehistoric corn cobs were found in the dry sediments of this site. Additional cultural materials include a baby cradle (Dellinger 1936), ceramics (Dellinger and Dickinson 1942), a gourd container (Scholtz 1968), a substantial assemblage of cordage and basketry (Scholtz 1975), and extensive faunal remains (Cleland 1965).

The picture that emerges from these data suggests that a distinctive regional variant of Mississippian culture (cf. Smith 1978) developed in the central Ozarks. By Woodland times, a sedentary adaptation was in place among small scale populations supported by a mixed subsistence economy that included limited production of indigenous domesticants as well as the tropical cultigen maize. It appears that the Mississippian period witnessed an intensification of domesticated plant production, although the overall subsistence economy retained its broad spectrum of wild and domesticated resources. A diversified settlement pattern is identified during both periods: open sites along river terraces as well as rockshelters were inhabited. During the Mississippi period, square to rectangular wall post houses were built on open river terrace sites. There is no evidence, however, for the construction and use of ceremonial mound centers in the central Ozarks during the Mississippi period.

Further investigation of Mississippian sites in this region would contribute significant information concerning the multilineal trajectory of Mississippian cultural developments across eastern North America. In this regard it is important to note that the Boxley Valley and the Rush locality are the only two areas where sites containing stratified Woodland and Mississippian components have been identified in the Buffalo National River.

Intersite Analysis: Aboriginal Use of the Rush Locality

W. FREDRICK LIMP

Chapter 2, on local environmental parameters, characterizes the environment along a number of dimensions which may have been of either direct or indirect influence on the aboriginal inhabitants of the Dirst site. We should recognize, however, that the area has undergone complex changes over the centuries, both during its occupation and since its last aboriginal use. Specific local information on geomorphological changes has been presented elsewhere in this report. In addition to the local processes, primarily of an alluvial nature, the study area has also experienced larger scale changes as a result of Euroamerican deforestation and the introduction of agricultural practices in the area (by Euroamericans and, possibly to a much lesser degree, by the aboriginal inhabitants). The substantial deforestation in the late 1800s, and particularly in the early 1900s, almost certainly led to substantially increased erosion and, therefore, increased colluvial deposition, particularly at the interface between the valley slopes and floodplain/terrace. Erosion of the soil on much of the uplands may also have reduced the productivity of these locations. From early Euroamerican accounts of the area, it also seems likely that areas of prairie were present in many upland locations. The precise origin of these locations is unclear, but it is possible that they may have been due, at least in part, to aboriginal burning. In short, we must exercise caution in any attempts to extrapolate, uncritically, modern conditions into the past. With such acknowledgement, however, there is considerable merit in considering the possible utilization of the area by prehistoric inhabitants of the Rush site.

It is commonly recognized that use of the area around a site is influenced, at least in part, by its relative proximity to the site. This is the basis for "site catchment analysis." There are a number of "catches" in catchment studies, as we have documented elsewhere (Limp and Carr 1986), nonetheless such an approach can provide useful insights into the potential usage of an area. In the following sections we will consider the Dirst site from two different catchment perspectives. The first, a traditional catchment analysis, looks at a site's resource potential in a series of concentric rings of increasing distance from the site. A presumption of such concentric rings is that travel is equally feasible in all directions at an equivalent "movement cost." Anyone visiting the Dirst site immediately recognizes the fallacy of such a view since, in many places, the walls of the Buffalo River Valley are so steep and tall as to be virtually impassable. With the capabilities of the Geographic Information Systems (GIS), we can increase the realism of our catchment modeling by actually considering the "cost" of movement over any location using any set of criteria. For example, we may determine that, as slope increases, it becomes increasingly difficult to continue to move. The addition of even this simple factor improves the realism of the catchment approach. However, additional criticisms can be leveled against any

form of catchment analysis, even those with more sophisticated assumptions. Ethnographically there are numerous examples of groups and individuals traveling considerable distances to utilize specific resources, and many other legitimate criticisms can be leveled. These notwithstanding, we believe that, with the addition of analytical procedures made possible through the use of a GIS, catchment analysis can become considerably more realistic and sophisticated in its application and, with appreciation for its limitations, can continue to have considerable merit.

A Traditional Catchment Analysis

In the following we will briefly consider the results of a traditional catchment analysis of the site with respect to agriculturally productive soils. Our primary purpose is to provide a contrast to the later, more realistic cost surface catchment models. Figure 12-1 is a map showing the distribution of the area's agricultural soils overlain by five catchments of one, two, three, four, and five kilometers, respectively. Using the GIS capabilities we can tabulate the occurrence of the various categories of each capability class. If the Rush inhabitants were practicing agriculture, we might propose that the site would be located such that agriculturally productive soils were located in reasonably close proximity to the site. Table 12-1 compares the hectares and percentages of each capability class for each of the catchments.

Table 12-1. Agricultural capability for circular catchments.

Catchment	Primary		Secondary		Marginal		Unlikely	
	ha	%	ha	%	ha	%	ha	%
0 to 1 km	5.4	1.7	37.8	12.0	60.1	19.0	212.8	67.3
1 to 2 km	15.2	1.6	160.9	17.3	71.2	7.6	684.4	73.5
2 to 3 km	15.6	1.0	215.6	13.9	282.5	18.2	1036.8	66.9
3 to 4 km	22.9	1.1	382.3	17.7	239.1	11.1	1518.6	70.2
4 to 5 km	59.6	2.2	393.2	14.6	594.5	21.4	1726.8	62.2
Total Area		1.1		16.1		15.1		67.6
Total Area includes areas not within catchments.								

Examination of the table indicates that, while there may be a slightly greater percentage of primary agricultural soils in close proximity to the Dirst site, the relationship is by no means strong and may easily be due to any of a number of factors not related to the site itself. We must admit, however, that the discovery of any patterning with these circular catchments would have come as a considerable surprise given the area's topography. Having briefly considered this traditional approach, we will quickly turn to what we believe is a much more realistic one.

Figure 12-1. Comparison of agriculture soil classes and circular catchments at the Rush site.

Cost Movement Catchment

In this approach we consider the fact that conditions on the surface make movement either easier or harder. As a first approximation we can presume that as a location's slope increases it becomes increasingly more costly to move across that location. In a fundamental sense the circular catchment presumes that movement in all directions is with a uniform cost. Another way of expressing movement cost would be to see the movement surface as having a variable friction for each location, where the coefficient of friction is based on factors such as slope--and we are by no means limited to slope, as we will see below. In assigning a cost (or coefficient of friction) to each location based on its slope, the next issue becomes how to measure this cost. We have a slope value for each 30 m cell in the study area with the values ranging from 1 (no slope) to 44 (43 degrees of slope). The GRASS GIS reserves the value, or category, 0 (zero) for "no data," thus a flat location, one with zero slope, is assigned to the category 1. We might wish to simply use these values. In doing so we would be presuming that as slope increases the cost increases linearly. Thus, a location that has a slope of 20 degrees is four times more difficult to traverse than a location with only 5 degrees of slope. While such a view has merit, we feel it more reasonable to presume that as slope increases it becomes significantly more difficult to traverse the location. One way to model this would be to take the cost to be increasing as the square of the slope. Thus no slope (class 1) would have a cost of 1 to traverse it (1 x 1 = 1). A slope of 1 degree (class 2) would be four times as costly (2 x 2 = 4). For our first example a location of 20 degrees would be approximately 12 times more difficult to traverse than a location with just 5 degrees of slope (21 x 21 = 441, 6 x 6 = 36, 441/36 = 12.25). This computation then creates a surface in which each cell has as its value the cost of traversing it. The cumulative cost surface is created by effectively radiating out from the point of origin in all directions and adding the values encountered in each cell, creating a cumulative surface. Therefore, if the cell nearest the site has a traversal cost of 9, the next 16, and the next 1, the total cost to move to the third cell would be 9+16+1, or 26 units of "effort." Using this logic we can produce a cost movement surface radiating outward from the Rush site.

The surface is shown in Figure 12-2. As would be expected, this catchment map is quite irregular in shape, reflecting the relative ease with which movement is possible up and down the Buffalo River Valley, as well as the relative ease of moving up the Rush and Clabber Creek valleys to the northwest. Both of these valleys provide a relatively easy route out of the valley to the uplands, an option which is not available at many locations in the valley.

As we did for the circular catchment we can investigate the relative occurrence of potential resources within variable catchments around the site. For purposes of comparison, it would be useful to have catchments which are equivalent to the 1, 2, 3, 4, and 5 km circular catchments. The traditional circular catchment implies in essence that the cost of traversal of all locations is uniform, i.e., that each cell has a value of 1. As we mentioned before, a circular catchment simply presumes uniform movement cost of one for each cell traversed. With the 30 m cells we are using, the 1 km catchment implies traversal of 33 cells (30 m x 33 cells = 990 m). If each cell has a cost of 1, then the cumulative cost is 33. We can look at our cost surface and identify

Figure 12-2. Cost catchments based on slope compared to hydrography.

those locations with a cumulative cost of 33 and include all cells with 33 or less as "comparable" to the 1 km circular catchment. In terms of their relative "effort," a 1 km catchment which requires traversal of 33 cells would be comparable to the traversal, for example, of seven cells with costs of 1, 1, 9, 16, 4, 1, and 1. This set of seven cells might be the result of a flat area (two cells with 1), a rise that caused the slope to rise to category 4 (yielding a cost of 16), and then back down to a flat stretch (two cells with a traversal cost of 1). In the following tables, a catchment which is the "effort" equivalent of each circular catchment is computed by using the cumulative cost curves. Thus, a cost catchment equivalent to a 3 km circular catchment would be those cells in which the cumulative cost was under 100 units. Since the cells are each 30 m on a flat surface, a traveler would traverse 100 30 m cells to move 3 km. Similar logic can be applied to the other catchments. The amount of the area encompassed by the cost catchment will be considerably less than the equivalent circular catchments. With this in mind, however, we can use these means for assessing some rough comparability between the two. Table 12-2 indicates the agricultural capabilities for each cost catchment.

Table 12-2. Agricultural capability for cost catchments.

Catchment	Primary		Secondary		Marginal		Unlikely	
	ha	%	ha	%	ha	%	ha	%
Cost = 1 km	0.4	0.3	0.9	0.6	34.7	24.5	105.2	74.6
Cost = 3 km	18.6	4.1	5.9	1.3	121.3	26.7	309.3	67.9
Cost = 5 km	47.0	4.7	20.5	2.0	290.5	28.8	650.2	64.5
Cost = 10 km	78.8	3.2	84.3	3.4	863.9	34.5	1476.1	59.0
Total Area		1.1		16.1		15.1		67.6
Total Area includes areas not within catchments.								

Because the catchments are quite a bit smaller than the circular ones, we have added a 10 km equivalent catchment to the table. Figure 12-3 shows the 1, 5, and 10 km catchments overlain as vector outlines drawn on the agricultural capabilities map.

As we examine these values and compare them with the circular catchments, a number of interesting patterns emerge. First, the cost surface model has considerably greater percentages for the primary agricultural soils than did the circular model, though in both cases the numbers are small. Conversely, the cost model has greater percentages in the unlikely class. It seems reasonable to ascribe this structure to the following situation. The Dirst site is well situated to take advantage of the floodplain areas, both for their agricultural potential (for the later groups) and for the abundance of floodplain plants and animals that would be present. In addition, however, the site was also well suited to allow utilization of the extensive uplands and the many wild resources available in that location. Based on the data available, if the (later) Dirst inhabitants were

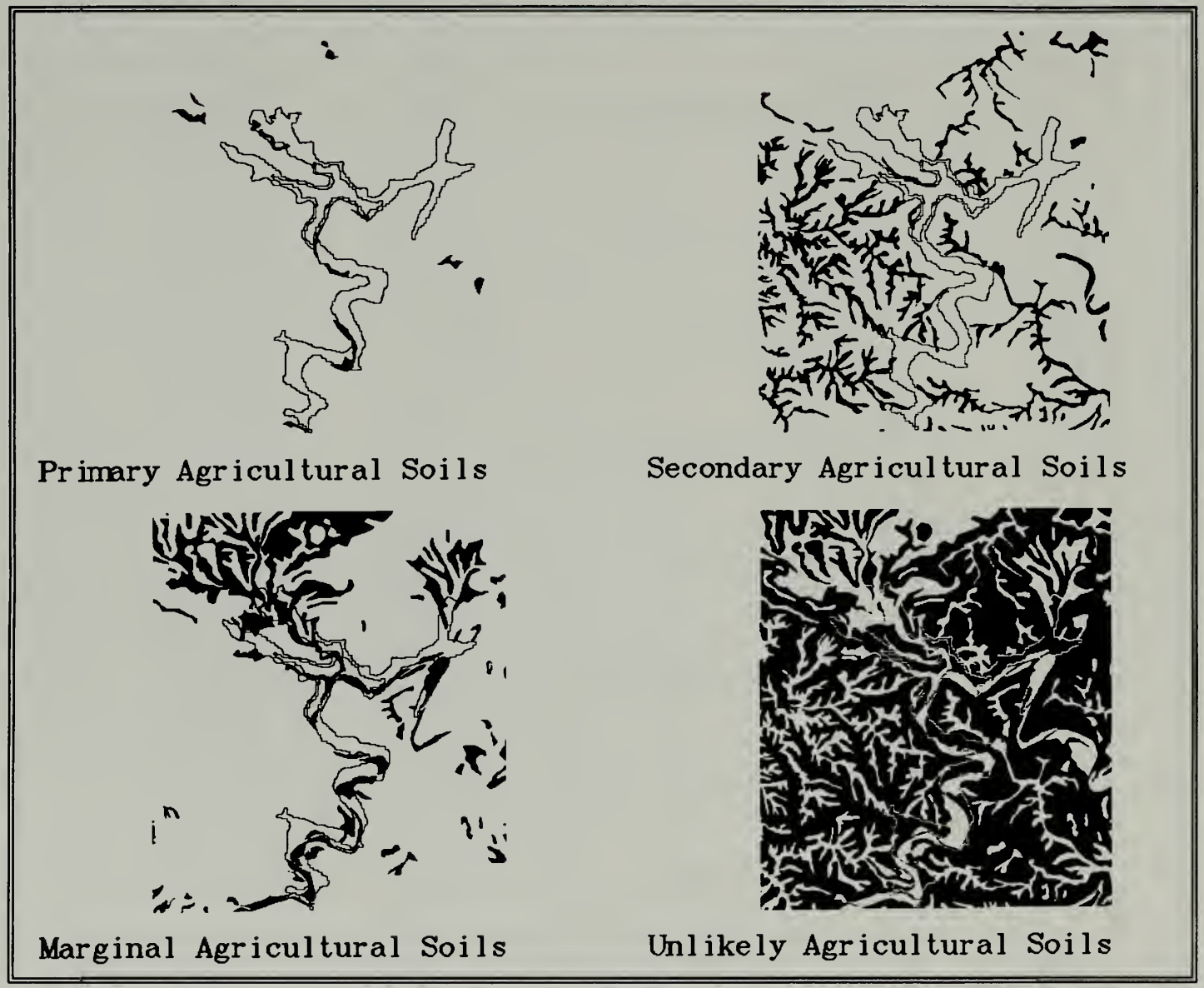


Figure 12-3. Comparison of 1 km and 5 km equivalent cost contours to agricultural soils.

practicing agriculture (or horticulture), there would have been other locations in the Buffalo River Valley which would have provided closer proximity to primary agricultural soils, but these locations would not have had the easy access to the uplands that the Rush Creek and Clabber Creek valleys provided.

In addition to comparing these cost catchments to the area's agricultural soils, we can also compare them to the mapped presettlement vegetation zones. We can visually compare the catchments to the presettlement vegetation map as shown in Figures 12-4a and 12-4b. The relative areas for each catchment are presented in Table 12-3.

Table 12-3. Presettlement forest zones in cost catchments.

	Black Oak Dominant	White Oak Dominant	Black-White Oak Codominant	Oak-Pine Codominant	Pine Dominant	Cedar	Mixed Hardwoods	Flood Plain
Cost = 1 km	17.9	3.6	2.7	39.4	5.6	18.9	3.7	8.2
Cost = 3 km	17.5	7.7	3.3	44.8	4.1	11.3	5.2	6.1
Cost = 5 km	19.3	8.9	2.5	41.4	4.3	8.8	6.8	8.0
Cost = 10 km	24.1	10.0	3.6	41.9	3.8	4.5	5.8	6.4
Total Area	27.4	20.8	4.2	34.1	8.0	1.4	2.0	2.0

Total Area includes areas not within catchments.

As expected, the cost catchments include considerably more floodplain forest than would be expected simply by chance; both Black and White Oak are under-represented, at least in the closer catchments; and cedar glades are over-represented. Cedar glades are common in the Rush Creek valley itself.

Expanding the Cost Model

Although the addition of slope to the movement modeling process increases its realism, it is clear that there are other factors that may influence the ability of an individual to travel. In the Rush area an obvious factor is the Buffalo River itself. In this part of the valley it is a stream of some considerable size (ca. 25 m wide) and, particularly after rains, it would be quite difficult to cross. Again, using the GIS, it is quite easy to introduce such an additional factor. As before, we need to determine what impact such a stream crossing might have in comparison with the slope impacts. There is always a degree of arbitrariness in any value, but it appears defensible to set the cost of a significant stream crossing to be as costly as traversing a steep slope. Traversing a 20 degree slope has been assigned a cost of 441, and we set the stream crossing at 425. Thus, as the computation proceeds, the model will "cross" the stream if the only other alternative is to traverse a steep location.

Figure 12-4a. Cost catchments compared to distribution of Black Oak.

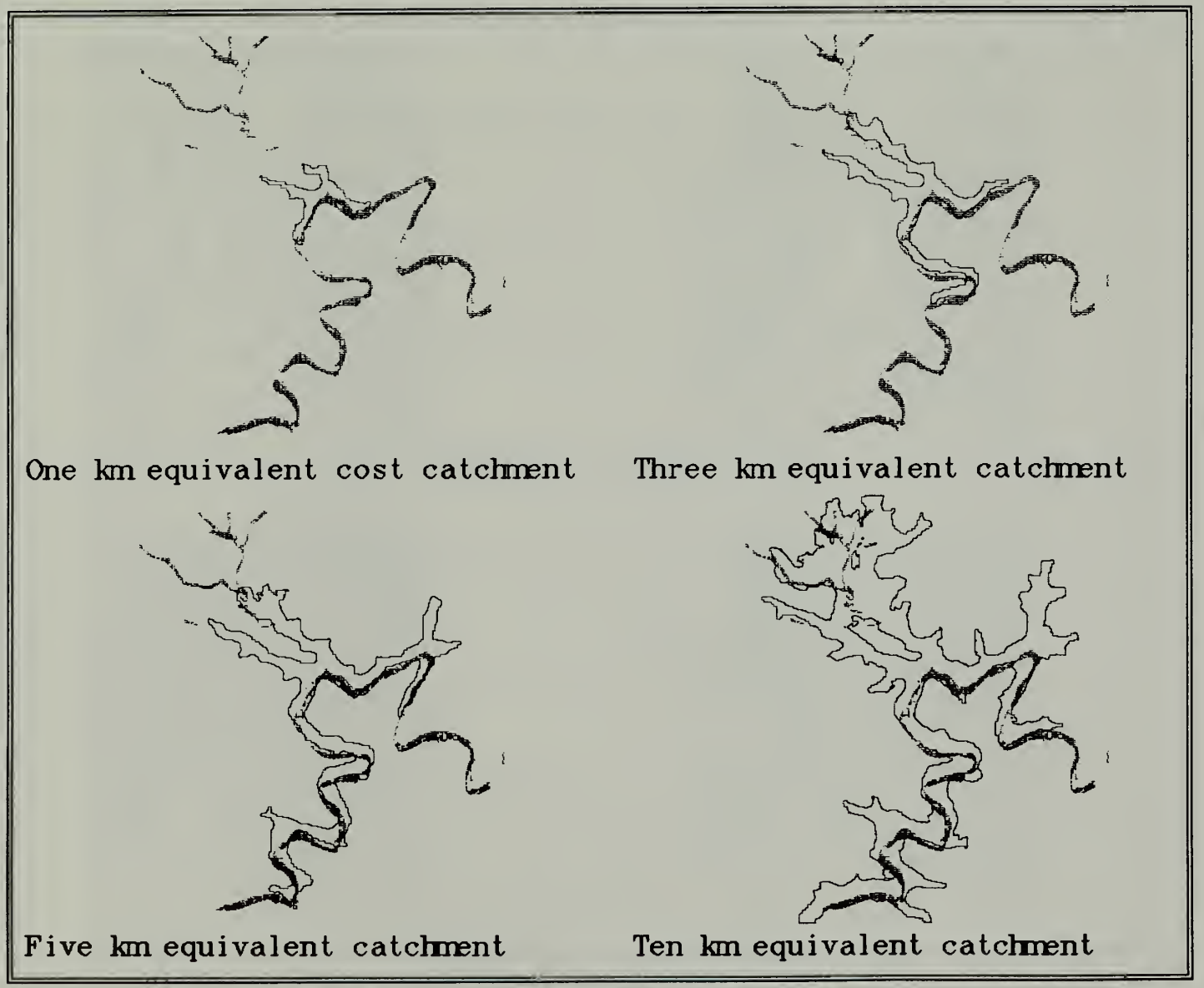


Figure 12-4b. Cost catchments compared to distributions of mixed hardwoods and floodplain forest.

Figure 12-5 and Table 12-4 illustrate the cost catchments which are a result of factoring the river as a barrier to travel. Comparing these catchments to the earlier model, we can see that movement upriver (to the south) is possible for some distance but is finally blocked when the river swings up against the steep bluff. It is important to emphasize that the model recognizes only current conditions. The river's location within the valley undoubtedly changed during the period the site was occupied. We believe that it is reasonable to presume, however, that while the exact location where the river encounters the bluff (blocking travel) may have changed, such a situation would have existed prehistorically somewhere within the area. If the river did influence travel in such a manner, then the accessible locations up the Rush and Clabber Creek valleys become of even greater consequence.

Table 12-4. Agricultural capability for cost catchments where the river is a barrier to travel.

Catchment	Primary		Secondary		Marginal		Unlikely	
	ha	%	ha	%	ha	%	ha	%
Cost = 1 km	0.0	0.0	0.9	0.7	26.3	20.9	98.6	78.4
Cost = 3 km	9.6	2.9	5.6	1.7	93.9	28.4	221.7	67.0
Cost = 5 km	14.6	2.7	11.5	2.1	153.8	27.9	370.8	67.3
Cost = 10 km	36.1	2.2	37.6	2.3	622.1	38.6	916.3	56.8
Total Area		1.1		16.1		15.1		67.6
Total Area includes areas not within catchments.								

If the river was a barrier, then it would have substantially reduced the availability of primary and even secondary agricultural soils. In the first model there were 18.6 ha of primary agricultural soils within the "3 km" cost catchment. Adding the river as a factor in accessibility, then the amount of primary agricultural soils within the catchment falls to only 9.6 ha. Not only does the absolute amount decline, as would be expected if an additional limit was placed on movement, but the relative amount of the primary soils also decreases. Clearly, access to agricultural soils across the river was a factor in the earlier model.

In addition to the agricultural productivity issue we can consider the impact of limited travel on access to the area's presettlement vegetation zones (Table 12-5). Again we need to emphasize that only a portion of the area has such zones mapped.

Comparing the cost catchments with and without the river, we can easily see that the introduction of the river into our analysis substantially reduces the importance of the floodplain resource zone. In general, it drops by a factor of one-third to one-half. The mixed hardwood zone increases in importance, but the numbers are small and should be used with caution. The cedar glade zone increases, reflecting the increased dominance of the Rush and Clabber Creek valleys in the area within the cost catchments.

Figure 12-5. Cost catchments where the river is a barrier to travel.

Table 12-5. Presettlement vegetation zones in cost catchments where the river is a barrier to travel.

	Black Oak Dominant	White Oak Dominant	Black-White Oak Codominant	Oak-Pine Codominant	Pine Dominant	Cedar	Mixed Hardwoods	Flood Plain
Cost = 1 km	20.0	1.7	3.1	43.8	6.1	20.1	0.3	5.0
Cost = 3 km	22.2	5.4	4.5	47.5	4.7	8.9	2.4	4.3
Cost = 5 km	23.0	5.5	3.5	50.6	4.1	5.8	2.8	4.7
Cost = 10 km	27.4	8.6	4.6	47.6	2.2	2.6	2.7	4.3
Total Area	27.4	20.8	4.2	34.1	8.0	1.4	2.0	2.0

Total Area includes areas not within catchments.

We could further refine the model by viewing the river not as an impediment to travel but as a facilitator via waterborne transport. We will not apply this approach here because of the limited area for which we have digital data. A similar study (Limp 1989b) indicates that, depending on the cost factors, such an approach would open up a considerable extent of the Buffalo River Valley to the model.

In viewing these models it is clear that the Dirst site's location is one from which both floodplain and non-floodplain resources are accessible. It is not the "best" location for either, but it clearly is superior for a mixed strategy which utilizes both zones. While the Dirst site's location provides access to the uplands resources, it also may be important that the site's location provides access for travel in and out of the valley, perhaps facilitating trade or other activities which require more distant movement.

Access to Lithic Resources

In addition to the immediate environmental properties, the relationship of the Dirst site to more distant resources is also of interest. In particular, the availability of the critically important lithic resources can be evaluated using GIS tools. Using the statewide geological mapping units, maps were produced which display the distance for each cell (250 m) in the state of Arkansas to the three geological map units which included lithic resources of particular importance to the Dirst site's inhabitants. These were distances to map units containing Pitkin, Boone, and Cotter cherts. The distance maps for the entire Buffalo National River area are shown as Figures 12-6 to 12-8. We must emphasize that these distances are not necessarily distances to a chert outcrop but rather to the nearest edge of the mapped unit; the case may be, of course, that the nearest edge of a mapped unit may not be the location of an accessible outcrop.



Figure 12-6. Distance classes for distance to mapped locations of cotter dolomite (ocjc). Park boundary is shown as a dashed line.

Figure 12-7. Distance classes for distance to mapped locations of Pitkin limestone (mbfp). Park boundary is shown as a dashed line.



Figure 12-8. Distance classes for distance to mapped locations of Boone formation (mb). Park boundary is shown as a dashed line.

The site is immediately adjacent (within 500 to 750 m) to the mapped unit containing Boone chert. As can be seen in Figure 12-7 mapped units containing Boone chert are common in the vicinity of the site but the site is located on the northwestern edge of the unit. Distances to the other mapped units are greater, the distance to mapped units containing Cotter chert is in the range of 8.75 to 10 km. These mapped units are located northeast of the site. Probably the nearest accessible locations would be in the White River Valley near the mouth of the Buffalo River. Mapped units containing Pitkin chert are located to the southwest, south, and southeast of the site, with the nearest location some 15 to 16.5 km away. We need to caution the reader that these distances are "as the crow flies" and actual over-the-ground distances may vary considerably.

Of course lithic material may be obtained not only from the strata containing the materials but also from gravels which have eroded out from the parent material. Examining the maps we can see that both Boone and Pitkin materials are located upstream from the Rush site and may, therefore, be candidates for gravel deposits in the immediate vicinity of the site. In this regard it is interesting to note that two archeological sites recorded in the AMASDA data base for the Rush vicinity, 3MR160 and 3MR161, are identified as gravel accumulations littered with chipping debris. The Cotter map units are not found within the Buffalo River drainage, and probably the nearest gravel deposits with Cotter materials would be in the White River drainage near the mouth of the Buffalo.

Intersite Analysis

In addition to their relationships with the natural environment, the Dirst site inhabitants also must be considered with respect to the inhabitants of other sites. How does the Dirst site compare, in its natural setting, to the locations of other sites? Through such comparisons we can obtain further insights into the nature of the archeological record and the prehistoric cultural landscapes that it represents. Such intersite comparisons can be conducted at a variety of spatial resolutions. In the following discussions we will focus on the sites located within the previously defined study area. The site records for each site have been reviewed and each site characterized along two key dimensions: cultural affiliation and whether the site is an open site or a bluff-shelter.

Information on site location and other characteristics were available in the Arkansas Archeological Survey's AMASDA database (Hilliard and Riggs 1986). Information from the AMASDA database was transferred into the GRASS GIS where analyses were performed. A series of simple univariate statistics were computed to identify any patterning which might exist in the site distributions. Tables 12-6 to 12-23 present "Site Occurrence" reports prepared by the GRASS GIS for the ten Archaic open sites in the Rush area, for the eight Woodland open sites, and for the six Mississippian open sites. The tables illustrate the distribution of the sites with respect to: 1) elevation, 2) slope, 3) aspect, 4) soils, 5) agricultural potential, and 6) distance to streams. The first column in the table presents the category, the second column is the number of cells within this category (30x30 m), the third the percentage of the area these cells represent (excluding no data cells), the fourth the number of sites that would be expected if the total number were distributed proportionate to the

Table 12-6. Open Archaic period sites in the Rush locality with regard to elevation.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(1) 350-472 feet	1,783	1.2	0.1	0	0.123	1
(2) 475-596 feet	15,226	10.5	1.1	10	75.981	1
(3) 600-721 feet	24,381	16.9	1.7	0	1.687	1
(4) 724-846 feet	35,176	24.3	2.4	0	2.434	1
(5) 849-970 feet	38,866	26.9	2.7	0	2.689	1
(6) 974-1,095 feet	23,595	16.3	1.6	0	1.632	1
(7) 1,098-1,220 feet	5,177	3.6	0.4	0	0.358	1
(8) 1,223-1,344 feet	332	0.2	0.0	0	0.023	1
Total	144,536	100.0	10.0	10	84.927	7

Table 12-7. Open Woodland period sites in the Rush locality with regard to elevation.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(1) 350-472 feet	1,783	1.2	0.1	0	0.099	1
(2) 475-596 feet	15,226	10.5	0.8	8	60.784	1
(3) 600-721 feet	24,381	16.9	1.3	0	1.349	1
(4) 724-846 feet	35,176	24.3	1.9	0	1.947	1
(5) 849-970 feet	38,866	26.9	2.2	0	2.151	1
(6) 974-1,095 feet	23,595	16.3	1.3	0	1.306	1
(7) 1,098-1,220 feet	5,177	3.6	0.3	0	0.287	1
(8) 1,223-1,344 feet	332	0.2	0.0	0	0.018	1
Total	144,536	100.0	8.0	8	67.942	7

Table 12-8. Open Mississippi period sites in the Rush locality with regard to elevation.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(1) 350-472 feet	1,783	1.2	0.1	0	0.074	1
(2) 475-596 feet	15,226	10.5	0.6	6	45.588	1
(3) 600-721 feet	24,381	16.9	1.0	0	1.012	1
(4) 724-846 feet	35,176	24.3	1.5	0	1.460	1
(5) 849-970 feet	38,866	26.9	1.6	0	1.613	1
(6) 974-1,095 feet	23,595	16.3	1.0	0	0.979	1
(7) 1,098-1,220 feet	5,177	3.6	0.2	0	0.215	1
(8) 1,223-1,344 feet	332	0.2	0.0	0	0.014	1
Total	144,536	100.0	6.0	6	50.956	7

Table 12-9. Open Archaic period sites in the Rush locality with regard to slope.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(1) 0 to 2 degrees	31,391	21.7	2.2	4	1.539	1
(2) 3 to 6 degrees	37,756	26.1	2.6	3	0.058	1
(3) 10 to 15 degrees	33,515	23.2	2.3	1	0.750	1
(4) 16 to 25 degrees	10,115	7.0	0.7	0	0.700	1
(5) 26 to max, 43 degrees	692	0.5	0.0	0	0.048	1
Total	144,536	100.0	10.0	10	3.105	5

Table 12-10. Open Woodland period sites in the Rush locality with regard to slope.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(1) 0 to 2 degrees	31,391	21.7	1.7	5	6.126	1
(2) 3 to 6 degrees	37,756	26.1	2.1	1	0.568	1
(3) 7 to 9 degrees	31,067	21.5	1.7	1	0.301	1
(4) 10 to 15 degrees	33,515	23.2	1.9	1	0.394	1
(5) 16 to 25 degrees	10,115	7.0	0.6	0	0.560	1
(6) 26 to max, 43 degrees	692	0.5	0.0	0	0.038	1
Total	144,536	100.0	8.0	8	7.988	5

Table 12-11. Open Mississippi period sites in the Rush locality with regard to slope.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(1) 0 to 2 degrees	31,391	21.7	1.3	4	5.581	1
(2) 3 to 6 degrees	37,756	26.1	1.6	1	0.205	1
(3) 7 to 9 degrees	31,067	21.5	1.3	0	1.290	1
(4) 10 to 15 degrees	33,515	23.2	1.4	1	0.110	1
(5) 16 to 25 degrees	10,115	7.0	0.4	0	0.420	1
(6) 26 to max, 43 degrees	692	0.5	0.0	0	0.029	1
Total	144,536	100.0	6.0	6	7.635	5

Table 12-12. Open Archaic period sites in the Rush locality with regard to aspect.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(1) East facing	6,615	4.6	0.5	0	0.458	1
(2) 15 degrees north of east	5,417	3.7	0.4	1	1.043	1
(3) 30 degrees north of east	4,939	3.4	0.3	1	1.268	1
(4) Northeast facing	6,339	4.4	0.4	1	0.719	1
(5) 30 degrees east of north	5,821	4.0	0.4	0	0.403	1
(6) 15 degrees east of north	5,432	3.8	0.4	1	1.037	1
(7) North facing	6,007	4.2	0.4	1	0.822	1
(8) 15 degrees west of north	4,960	3.4	0.3	0	0.343	1
(9) 30 degrees west of north	5,046	3.5	0.3	0	0.349	1
(10) Northwest facing	5,143	3.6	0.4	2	7.597	1
(11) 30 degrees north of west	4,956	3.4	0.3	1	1.259	1
(12) 15 degrees north of west	5,501	3.8	0.4	1	1.008	1
(13) West facing	5,258	3.6	0.4	0	0.364	1
(14) 15 degrees south of west	5,541	3.8	0.4	0	0.383	1
(15) 30 degrees south of west	4,960	3.4	0.3	0	0.343	1
(16) Southwest facing	6,644	4.6	0.5	0	0.460	1
(17) 30 degrees west of south	6,206	4.3	0.4	0	0.429	1
(18) 15 degrees west of south	6,602	4.6	0.5	0	0.457	1
(19) South facing	6,705	4.6	0.5	0	0.464	1
(20) 15 degrees east of south	6,040	4.2	0.4	0	0.418	1
(21) 30 degrees east of south	5,560	3.8	0.4	0	0.385	1
(22) Southeast facing	5,976	4.1	0.4	0	0.413	1
(23) 30 degrees south of east	5,513	3.8	0.4	0	0.381	1
(24) 15 degrees south of east	5,921	4.1	0.4	0	0.410	1
(25) No aspect	7,434	5.1	0.5	1	0.459	1
Total	144,536	100.0	10.0	10	21.671	24

Table 12-13. Open Woodland period sites in the Rush locality with regard to aspect.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(1) East facing	6,615	4.6	0.4	0	0.366	1
(2) 15 degrees north of east	5,417	3.7	0.3	1	1.634	1
(3) 30 degrees north of east	4,939	3.4	0.3	1	1.931	1
(4) Northeast facing	6,339	4.4	0.4	1	1.201	1
(5) 30 degrees east of north	5,821	4.0	0.3	0	0.322	1
(6) 15 degrees east of north	5,432	3.8	0.3	1	1.627	1
(7) North facing	6,007	4.2	0.3	0	0.332	1
(8) 15 degrees west of north	4,960	3.4	0.3	0	0.275	1
(9) 30 degrees west of north	5,046	3.5	0.3	0	0.279	1
(10) Northwest facing	5,143	3.6	0.3	2	10.336	1
(11) 30 degrees north of west	4,956	3.4	0.3	0	0.274	1
(12) 15 degrees north of west	5,501	3.8	0.3	0	0.304	1
(13) West facing	5,258	3.6	0.3	0	0.291	1
(14) 15 degrees south of west	5,541	3.8	0.3	0	0.307	1
(15) 30 degrees south of west	4,960	3.4	0.3	0	0.275	1
(16) Southwest facing	6,644	4.6	0.4	0	0.368	1
(17) 30 degrees west of south	6,206	4.3	0.3	0	0.343	1
(18) 15 degrees west of south	6,602	4.6	0.4	0	0.365	1
(19) South facing	6,705	4.6	0.4	0	0.371	1
(20) 15 degrees east of south	6,040	4.2	0.3	0	0.334	1
(21) 30 degrees east of south	5,560	3.8	0.3	0	0.308	1
(22) Southeast facing	5,976	4.1	0.3	0	0.331	1
(23) 30 degrees south of east	5,513	3.8	0.3	0	0.305	1
(24) 15 degrees south of east	5,921	4.1	0.3	0	0.328	1
(25) No aspect	7,434	5.1	0.4	2	6.133	1
Total	144,536	100.0	8.0	8	28.942	24

Table 12-14. Open Mississippi period sites in the Rush locality with regard to aspect.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(1) East facing	6,615	4.6	0.3	0	0.275	1
(2) 15 degrees north of east	5,417	3.7	0.2	1	2.672	1
(3) 30 degrees north of east	4,939	3.4	0.2	1	3.082	1
(4) Northeast facing	6,339	4.4	0.3	1	0.063	1
(5) 30 degrees east of north	5,821	4.0	0.2	0	0.242	1
(6) 15 degrees east of north	5,432	3.8	0.2	1	2.660	1
(7) North facing	6,007	4.2	0.2	0	0.249	1
(8) 15 degrees west of north	4,960	3.4	0.2	0	0.206	1
(9) 30 degrees west of north	5,046	3.5	0.2	0	0.209	1
(10) Northwest facing	5,143	3.6	0.2	1	2.897	1
(11) 30 degrees north of west	4,956	3.4	0.2	0	0.206	1
(12) 15 degrees north of west	5,501	3.8	0.2	0	0.228	1
(13) West facing	5,258	3.6	0.2	0	0.218	1
(14) 15 degrees south of west	5,541	3.8	0.2	0	0.230	1
(15) 30 degrees south of west	4,960	3.4	0.2	0	0.206	1
(16) Southwest facing	6,644	4.6	0.3	0	0.276	1
(17) 30 degrees west of south	6,206	4.3	0.3	0	0.258	1
(18) 15 degrees west of south	6,602	4.6	0.3	0	0.274	1
(19) South facing	6,705	4.6	0.3	0	0.278	1
(20) 15 degrees east of south	6,040	4.2	0.3	0	0.251	1
(21) 30 degrees east of south	5,560	3.8	0.2	0	0.231	1
(22) Southeast facing	5,976	4.1	0.2	0	0.248	1
(23) 30 degrees south of east	5,513	3.8	0.2	0	0.229	1
(24) 15 degrees south of east	5,921	4.1	0.2	0	0.246	1
(25) No aspect	7,434	5.1	0.3	1	1.549	1
Total	144,536	100.0	6.0	6	19.484	24

Table 12-15. Open Archaic period sites in the Rush locality with regard to soil type.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(0)	17,486			0		
(1) Estate-Portia-Moko assoc	46,998	37.0	3.7	0	3.699	1
(2) Clarksville very cherty	35,588	28.0	2.8	0	2.801	1
(3) Nixa very cherty silt loam	19,858	15.6	1.6	0	1.563	1
(4) Estate-Portia-Moko assoc	13,494	10.6	1.1	4	8.127	1
(5) Wideman sandy loam-freq flood	3,907	3.1	0.3	5	71.604	1
(6) Moko-Rock outcrop complex	1,822	1.4	0.1	0	0.143	1
(7) Water	1,205	0.9	0.1	0	0.095	1
(8) Britwater silt loam	914	0.7	0.1	1	11.972	1
(9) Nixa-Noark complex	789	0.6	0.1	0	0.062	1
(10) Portia fine sandy loam	623	0.5	0.0	0	0.049	1
(11) Razort silt loam-freq flood	550	0.4	0.0	0	0.043	1
(12) Portia fine sandy loam	452	0.4	0.0	0	0.036	1
(13) Noark very cherty silt loam	378	0.3	0.0	0	0.030	1
(14) Arkana-Moko complex	276	0.2	0.0	0	0.022	1
(15) Nixa-Noark complex	124	0.1	0.0	0	0.010	1
(16) Britwater silt loam	48	0.0	0.0	0	0.004	1
(17) Britwater gravelly silt loam	22	0.0	0.0	0	0.002	1
(18) Nixa very cherty silt loam	2	0.0	0.0	0	0.000	1
Total	127,050	100.0	10.0	10	100.261	17

Table 12-16. Open Woodland period sites in the Rush locality with regard to soil type.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(0)	17,486			0		
(1) Estate-Portia-Moko assoc	46,998	37.0	3.0	0	2.959	1
(2) Clarksville very cherty	35,588	28.0	2.2	0	2.241	1
(3) Nixa very cherty silt loam	19,858	15.6	1.3	0	1.250	1
(4) Estate-Portia-Moko assoc	13,494	10.6	0.8	3	5.442	1
(5) Wideman sandy loam-freq flood	3,907	3.1	0.2	3	30.829	1
(6) Moko-Rock outcrop complex	1,822	1.4	0.1	0	0.115	1
(7) Water	1,205	0.9	0.1	0	0.076	1
(8) Britwater silt loam	914	0.7	0.1	2	65.560	1
(9) Nixa-Noark complex	789	0.6	0.0	0	0.050	1
(10) Portia fine sandy loam	623	0.5	0.0	0	0.039	1
(11) Razort silt loam-freq flood	550	0.4	0.0	0	0.035	1
(12) Portia fine sandy loam	452	0.4	0.0	0	0.028	1
(13) Noark very cherty silt loam	378	0.3	0.0	0	0.024	1
(14) Arkana-Moko complex	276	0.2	0.0	0	0.017	1
(15) Nixa-Noark complex	124	0.1	0.0	0	0.008	1
(16) Britwater silt loam	48	0.0	0.0	0	0.003	1
(17) Britwater gravelly silt loam	22	0.0	0.0	0	0.001	1
(18) Nixa very cherty silt loam	2	0.0	0.0	0	0.000	1
Total	127,050	100.0	8.0	8	108.678	17

Table 12-17. Open Mississippi period sites in the Rush locality with regard to soil type.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(0)	17,486			0		
(1) Estate-Portia-Moko assoc	46,998	37.0	2.2	0	2.220	1
(2) Clarksville very cherty	35,588	28.0	1.7	0	1.681	1
(3) Nixa very cherty silt loam	19,858	15.6	0.9	0	0.938	1
(4) Estate-Portia-Moko assoc	13,494	10.6	0.6	3	8.760	1
(5) Wideman sandy loam-freq flood	3,907	3.1	0.2	2	17.864	1
(6) Moko-Rock outcrop complex	1,822	1.4	0.1	0	0.086	1
(7) Water	1,205	0.9	0.1	0	0.057	1
(8) Britwater silt loam	914	0.7	0.0	1	21.211	1
(9) Nixa-Noark complex	789	0.6	0.0	0	0.037	1
(10) Portia fine sandy loam	623	0.5	0.0	0	0.029	1
(11) Razort silt loam-freq flood	550	0.4	0.0	0	0.026	1
(12) Portia fine sandy loam	452	0.4	0.0	0	0.021	1
(13) Noark very cherty silt loam	378	0.3	0.0	0	0.018	1
(14) Arkana-Moko complex	276	0.2	0.0	0	0.013	1
(15) Nixa-Noark complex	124	0.1	0.0	0	0.006	1
(16) Britwater silt loam	48	0.0	0.0	0	0.002	1
(17) Britwater gravelly silt loam	22	0.0	0.0	0	0.001	1
(18) Nixa very cherty silt loam	2	0.0	0.0	0	0.000	1
Total	127,050	100.0	6.0	6	52.969	17

Table 12-18. Open Archaic period sites in the Rush locality with regard to agricultural potential of the soil.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(0)	17,486			0		
(1) Primary	1,436	1.1	0.1	1	6.961	1
(2) Secondary	20,534	16.2	1.6	0	1.616	1
(3) Marginal	19,191	15.1	1.5	9	37.135	1
(4) Unlikely	85,889	67.6	6.8	0	6.760	1
Total	127,050	100.0	10.0	10	52.472	3

Table 12-19. Open Woodland period sites in the Rush locality with regard to agricultural potential of the soil.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(0)	17,486			0		
(1) Primary	1,436	1.1	0.1	2	40.328	1
(2) Secondary	20,534	16.2	1.3	0	1.293	1
(3) Marginal	19,191	15.1	1.2	6	19.000	1
(4) Unlikely	85,889	67.6	5.4	0	5.408	1
Total	127,050	100.0	8.0	8	66.029	3

Table 12-20. Open Mississippi period sites in the Rush locality with regard to agricultural potential of the soil.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(0)	17,486			0		
(1) Primary	1,436	1.1	0.1	1	12.814	1
(2) Secondary	20,534	16.2	1.0	0	0.970	1
(3) Marginal	19,191	15.1	0.9	5	18.491	1
(4) Unlikely	85,889	67.6	5.4	0	4.056	1
Total	127,050	100.0	6.0	6	36.330	3

Table 12-21. Open Archaic period sites in the Rush locality with regard to distance to streams.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(0) Location from which distance	5,888			0		
(1) 0.00 to 90.00 meters	27,730	20.0	2.0	9	24.499	1
(2) 90.00 to 180 meters	26,177	18.9	1.9	1	0.418	1
(3) 180.00 to 270.00 meters	23,614	17.0	1.7	0	1.703	1
(4) 270.00 to 360.00 meters	20,127	14.5	1.5	0	1.452	1
(5) 360.00 to 450.00 meters	15,157	10.9	1.1	0	1.093	1
(6) 450.00 to 540.00 meters	10,888	7.9	0.8	0	0.785	1
(7) 540.00 to 630.00 meters	6,689	4.8	0.5	0	0.482	1
(8) 630.00 to 720.00 meters	4,048	2.9	0.3	0	0.292	1
(9) 720.00 to 810.00 meters	2,484	1.8	0.2	0	0.179	1
(10) 810.00 to 900.00 meters	1,316	0.9	0.1	0	0.095	1
(11) 900.00 to 990.00 meters	400	0.3	0.0	0	0.029	1
(12) 990.00 to 1,500.00 meters	18	0.0	0.0	0	0.001	1
Total	138,648	100.0	10.0	10	31.029	11

Table 12-22. Open Woodland period sites in the Rush locality with regard to distance to streams.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(0) Location from which distance	5,888			0		
(1) 0.00 to 90.00 meters	27,730	20.0	1.6	6	12.100	1
(2) 90.00 to 180 meters	26,177	18.9	1.5	2	0.159	1
(3) 180.00 to 270.00 meters	23,614	17.0	1.4	0	1.363	1
(4) 270.00 to 360.00 meters	20,127	14.5	1.2	0	1.161	1
(5) 360.00 to 450.00 meters	15,157	10.9	0.9	0	0.875	1
(6) 450.00 to 540.00 meters	10,888	7.9	0.6	0	0.628	1
(7) 540.00 to 630.00 meters	6,689	4.8	0.4	0	0.386	1
(8) 630.00 to 720.00 meters	4,048	2.9	0.2	0	0.234	1
(9) 720.00 to 810.00 meters	2,484	1.8	0.1	0	0.143	1
(10) 810.00 to 900.00 meters	1,316	0.9	0.1	0	0.076	1
(11) 900.00 to 990.00 meters	400	0.3	0.0	0	0.023	1
(12) 990.00 to 1,500.00 meters	18	0.0	0.0	0	0.001	1
Total	138,648	100.0	8.0	8	17.148	11

Table 12-23. Open Mississippi period sites in the Rush locality with regard to distance to streams.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(0) Location from which distance	5,888			0		
(1) 0.00 to 90.00 meters	27,730	20.0	1.2	5	12.033	1
(2) 90.00 to 180 meters	26,177	18.9	1.1	1	0.016	1
(3) 180.00 to 270.00 meters	23,614	17.0	1.0	0	1.022	1
(4) 270.00 to 360.00 meters	20,127	14.5	0.9	0	0.871	1
(5) 360.00 to 450.00 meters	15,157	10.9	0.7	0	0.656	1
(6) 450.00 to 540.00 meters	10,888	7.9	0.5	0	0.471	1
(7) 540.00 to 630.00 meters	6,689	4.8	0.3	0	0.289	1
(8) 630.00 to 720.00 meters	4,048	2.9	0.2	0	0.175	1
(9) 720.00 to 810.00 meters	2,484	1.8	0.1	0	0.107	1
(10) 810.00 to 900.00 meters	1,316	0.9	0.1	0	0.057	1
(11) 900.00 to 990.00 meters	400	0.3	0.0	0	0.017	1
(12) 990.00 to 1,500.00 meters	18	0.0	0.0	0	0.001	1
Total	138,648	100.0	6.0	6	15.716	11

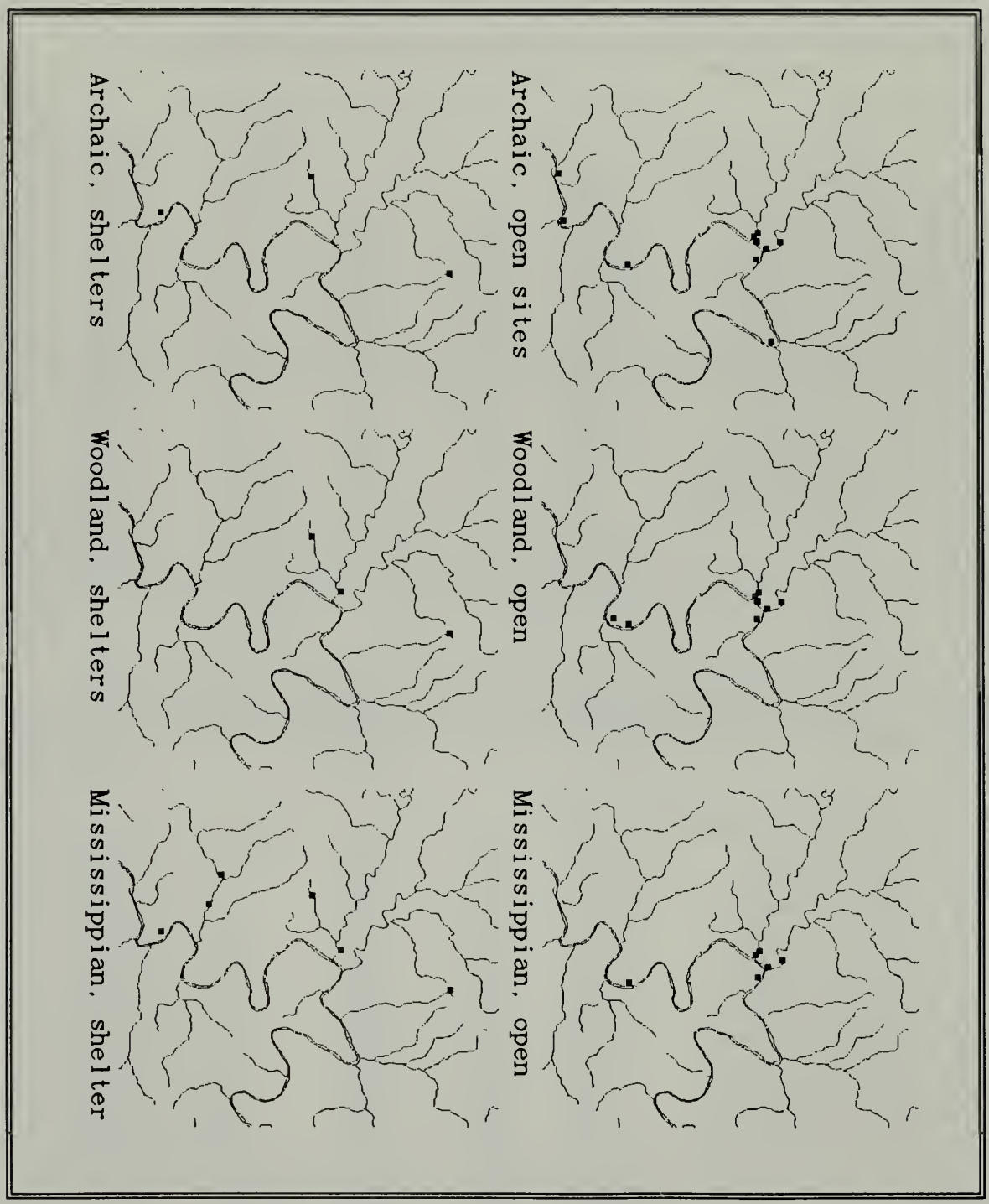


Figure 12-9. Distribution of archeological sites in Rush locality.

With this in mind we can observe some potential patterning in the distribution. It would appear that all the open sites are restricted to the single elevation zone (475 to 596). In area, this zone largely encompasses the Buffalo River floodplain and adjacent terraces. With respect to slope the sites are generally grouped, as expected, on the flatter locations. This is particularly true of the Mississippian sites. The Archaic sites appear in a much wider range of slopes than the Mississippian sites, while the Woodland sites are intermediate in their distribution. Although caution is appropriate in using such data, it would appear reasonable to conclude that the Archaic sites are distributed with relatively less concern for slope while the Woodland and particularly Mississippian sites are more likely to occur on the flatter locations. Remember that we are only considering "open" sites, and that bluffshelters are not part of the sample at this point. No aspect appears to be particularly significant.

With respect to soil type, it appears possible that the Wideman sandy loam may have been more commonly selected than would be due only to chance. This is a frequently flooded but well-drained soil in close proximity to the Buffalo River. In general, it would be a good candidate for a intermittent campsite and perhaps for a more permanent occupation except during the flood season. Of course the frequency and intensity of prehistoric flooding may have been substantially different from modern patterns, and this soil may not have been subjected to frequent floods in the past. With respect to the agricultural potential of the site locations, there appears to be a tendency during all periods to use the marginal agricultural soils. This pattern may simply be a result of the fact that the Wideman soils are classed into the marginal agriculturally productive category. Sites from all periods are in close proximity to streams, with the great majority occurring within the 0 to 90 m category. The Britwater silt loam also has a higher site frequency than expected by chance, but as only one site is represented for both Archaic and Mississippian groupings, this may not be of consequence.

By way of elaboration we can contrast the open sites with the bluffshelters in the same study area. To a certain degree research in the Buffalo River area has tended to emphasize the bluffshelters at the expense of the open sites, and it is of some interest to compare the environmental characteristics of these substantially different site types. The shelters in the area were assigned to different cultural affiliations but, because their number was so small, it was decided to group all the shelter sites together for this analysis. A total of seven shelters are recorded in the area. Tables 12-24 to 12-29 present the same data categories for the shelters as was previously presented for open sites. The shelters, expectedly, occur over a considerably wider range of elevations and slopes than did the open sites. There was no clear domination by any aspect, which was a bit surprising, as it was initially suspected than the south-facing aspects might be the more common. Shelters were distributed by soil type with no clear emphasis; however, when the soils were reclassed into the agricultural potential classes, shelters were somewhat more frequent on the "unlikely" class than would be expected if the sites were proportionally distributed.

There are a variety of additional archeological topics that can be investigated using GIS. As demonstrated in the preceding examples, GIS applications can be made on the level of the single site or can be used to identify and analyze intersite patterning on a local or regional level. There is, in summary, a tremendous potential for the application of GIS analysis to further our understanding of cultural resources in the Buffalo National River.

Table 12-24. Bluffshelters in the Rush locality with regard to elevation.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(1) 356 to 472 feet	1,783	1.2	0.1	0	0.086	1
(2) 475 to 596 feet	15,226	10.5	0.7	2	2.162	1
(3) 600 to 721 feet	24,381	16.9	1.2	2	0.568	1
(4) 724 to 846 feet	35,176	24.3	1.7	1	0.291	1
(5) 849 to 970 feet	38,866	26.9	1.9	0	1.882	1
(6) 974 to 1095 feet	23,595	16.3	1.1	2	0.643	1
(7) 1,098 to 1,220 feet	5,177	3.6	0.3	0	0.251	1
(8) 1,223 to 1,344 feet	332	0.2	0.0	0	0.016	1
Total	144,536	100.0	7.0	7	5.899	7

Table 12-25. Bluffshelters in the Rush locality with regard to slope.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(1) 0 to 2 degrees	31,391	21.7	1.5	3	1.440	1
(2) 3 to 6 degrees	37,756	26.1	1.8	1	0.375	1
(3) 7 to 9 degrees	31,067	21.5	1.5	0	1.505	1
(4) 10 to 15 degrees	33,515	23.2	1.6	2	0.087	1
(5) 16 to 25 degrees	10,115	7.0	0.5	1	0.531	1
(6) 26 to max, 43 degrees	23,595	16.3	1.1	2	0.643	1
Total	144,536	100.0	7.0	7	3.972	5

Table 12-26. Bluffshelters in the Rush locality with regard to aspect.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(1) East facing	6,615	4.6	0.3	0	0.320	1
(2) 15 degrees north of east	5,417	3.7	0.3	0	0.262	1
(3) 30 degrees north of east	4,939	3.4	0.2	0	0.239	1
(4) Northeast facing	6,339	4.4	0.3	0	0.307	1
(5) 30 degrees east of north	5,821	4.0	0.3	2	10.471	1
(6) 15 degrees east of north	5,432	3.8	0.3	0	0.263	1
(7) North facing	6,007	4.2	0.3	1	1.728	1
(8) 15 degrees west of north	4,960	3.4	0.2	0	0.240	1
(9) 30 degrees west of north	5,046	3.5	0.2	0	2.336	1
(10) Northwest facing	5,143	3.6	0.2	0	0.249	1
(11) 30 degrees north of west	4,956	3.4	0.2	0	0.240	1
(12) 15 degrees north of west	5,501	3.8	0.3	0	0.266	1
(13) West facing	5,258	3.6	0.3	0	0.255	1
(14) 15 degrees south of west	5,541	3.8	0.3	0	0.268	1
(15) 30 degrees south of west	4,960	3.4	0.2	0	0.240	1
(16) Southwest facing	6,644	4.6	0.3	0	0.322	1
(17) 30 degrees west of south	6,206	4.3	0.3	0	0.301	1
(18) 15 degrees west of south	6,602	4.6	0.3	0	0.320	1
(19) South facing	6,705	4.6	0.3	0	0.325	1
(20) 15 degrees east of south	6,040	4.2	0.3	0	0.283	1
(21) 30 degrees east of south	5,560	3.8	0.3	0	0.269	1
(22) Southeast facing	5,976	4.1	0.3	1	1.745	1
(23) 30 degrees south of east	5,513	3.8	0.3	1	2.012	1
(24) 15 degrees south of east	5,921	4.1	0.3	0	0.287	1
(25) No aspect	7,434	5.1	0.4	1	1.138	1
Total	144,536	100.0	7.0	7	24.696	24

Table 12-27. Bluffshelters in the Rush locality with regard to soil type.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(0)	17,486			0		
(1) Estate-Portia-Moko assoc	46,998	37.0	2.6	5	2.244	1
(2) Clarksville very cherty	35,588	28.0	2.0	1	0.471	1
(3) Nixa very cherty silt loam	19,858	15.6	1.1	0	1.094	1
(4) Estate-Portia-Moko assoc	13,494	10.6	0.7	1	0.089	1
(5) Wideman sandy loam-freq flood	3,907	3.1	0.2	0	0.215	1
(6) Moko-Rock outcrop complex	1,822	1.4	0.1	0	0.100	1
(7) Water	1,205	0.9	0.1	0	0.066	1
(8) Britwater silt loam	914	0.7	0.1	0	0.050	1
(9) Nixa-Noark complex	789	0.6	0.0	0	0.043	1
(10) Portia fine sandy loam	623	0.5	0.0	0	0.034	1
(11) Razort silt loam-freq flood	550	0.4	0.0	0	0.030	1
(12) Portia fine sandy loam	452	0.4	0.0	0	0.025	1
(13) Noark very cherty silt loam	378	0.3	0.0	0	0.021	1
(14) Arkana-Moko complex	276	0.2	0.0	0	0.015	1
(15) Nixa-Noark complex	124	0.1	0.0	0	0.007	1
(16) Britwater silt loam	48	0.0	0.0	0	0.003	1
(17) Britwater gravelly silt loam	22	0.0	0.0	0	0.001	1
(18) Nixa very cherty silt loam	2	0.0	0.0	0	0.000	1
Total	127,050	100.0	7.0	7	4.510	17

Table 12-28. Bluffshelters in the Rush locality with regard to agricultural potential of the soil.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(0)	17,486			0		
(1) Primary	1,436	1.1	0.1	0	0.079	1
(2) Secondary	20,534	16.2	1.1	0	1.131	1
(3) Marginal	19,191	15.1	1.1	1	0.003	1
(4) Unlikely	85,889	67.6	4.7	6	0.340	1
Total	127,050	100.0	7.0	7	1.553	3

Table 12-29. Bluffshelters in the Rush locality with regard to distance to streams.

Site Characteristics	Cells Cover	% Cover	Expected Sites	Actual Sites	Chi Square	Degree of Freedom
(0) Location from which distance	5,888			0		
(1) 0.00 to 90.00 meters	27,730	20.0	1.4	6	15.114	1
(2) 90.00 to 180 meters	26,177	18.9	1.3	1	0.078	1
(3) 180.00 to 270.00 meters	23,614	17.0	1.2	0	1.192	1
(4) 270.00 to 360.00 meters	20,127	14.5	1.0	0	1.016	1
(5) 360.00 to 450.00 meters	15,157	10.9	0.8	0	0.765	1
(6) 450.00 to 540.00 meters	10,888	7.9	0.5	0	0.550	1
(7) 540.00 to 630.00 meters	6,689	4.8	0.3	0	0.338	1
(8) 630.00 to 720.00 meters	4,048	2.9	0.2	0	0.204	1
(9) 720.00 to 810.00 meters	2,484	1.8	0.1	0	0.125	1
(10) 810.00 to 900.00 meters	1,316	0.9	0.1	0	0.066	1
(11) 900.00 to 990.00 meters	400	0.3	0.0	0	0.020	1
(12) 990.00 to 1,500.00 meters	18	0.0	0.0	0	0.001	1
Total	138,648	100.0	7.0	7	19.471	11

Regional Comparison: 3MR80 and Emergent Mississippian Developments

GEORGE SABO III

The evidence summarized in preceding chapters documents the significance of the Dirst site within the framework of central Ozarks prehistory. However, the data and interpretations provided in this report demonstrate that the Dirst site also has significance with respect to larger patterns and processes in eastern North American prehistory. In particular, evidence preserved at this site reflecting cultural developments during the Middle to Late Woodland period bears importantly on current discussions concerning the emergence of Mississippian cultures in the midsouth.

To reiterate the primary conclusions reached in the preceding chapters, the Middle Woodland to Early Mississippian occupation at 3MR80-Area D represents a year round settlement inhabited by a sedentary community with a subsistence economy based on hunting, gathering, and domesticated plant production. Significantly, the archeobotanical evidence from this site reveals an comparatively early addition of maize to the previously established suite of squash/gourd and various indigenous seed crops. Despite this adaptation to domesticated plant production, harvesting of native forest resources remained an important element of the subsistence economy. Deer, in particular, were intensively hunted and the resources this species provided were extensively utilized. The Middle Woodland to Early Mississippian inhabitants of the Dirst site were also early innovators in the development of shell tempered pottery. These inhabitants also participated in external trade/exchange networks through which they maintained ties with more distant populations. The extraction of quartz crystal from local deposits also may have provided this community with a valuable commodity for trade. An increase in the size of population aggregates permanently residing in the Rush locality seems to be indicated by the various midden deposits that have been identified in the area, and therefore some corresponding increases in the complexity of local social organization may be inferred. There is no evidence for the construction and use of local mound centers in the central Ozark region, however. Finally, this trajectory of adaptive reorganization and cultural elaboration characterizing the Middle Woodland to Early Mississippian occupation of the Dirst site and Rush locality appears to have been stimulated by a combination of internal and external sociocultural factors rather than by external environmental changes.

These interpretations of late prehistoric lifeways at the Dirst site and in the Rush locality are similar to those attributed to several adjacent areas of the midsouth at the same time period. It therefore seems worthwhile to briefly compare this late prehistoric cultural profile, which we believe to be representative of the central Ozark region in general, with the cultural profiles reconstructed for several key Emergent Mississippian sites in nearby regions. Specifically, comparisons will be made with the eastern Ozarks, the central Mississippi Valley and adjacent Ozarks escarpment, the central and lower Arkansas River Valley, and the western Ozark fringe.

Eastern Ozarks

The cultural manifestation to which the final Dirst site occupation seems to be most closely related is represented by a series of Emergent Mississippian sites in the Ozark National Scenic Riverways area of southeast Missouri. For several years excavations at a number of sites have been carried out under the direction of James E. Price and Mark J. Lynott. Two sites in particular, Gooseneck and Owls Bend, have provided much of the data supporting current cultural reconstructions. These sites are dated by a series of radiocarbon assays to ca. 950 to 1,250 B.P. Recently, Lynott (1989) has published a summary of the long term research at these two sites.

Evidence from the Gooseneck and Owls Bend sites indicates that Emergent Mississippian populations in the eastern Ozarks developed from earlier Woodland cultures which had already established a sedentary settlement adaptation in the region. By Late Woodland times a mixed subsistence economy was in place that incorporated hunting, gathering, and domesticated crop production. Hunting activities were concentrated mainly on deer, but other small mammals and birds were occasionally captured. Fish, turtles, and mussels were important aquatic resources. Nuts, fruits, and seeds were gathered, and domesticated knotweed, maygrass, sunflower, little barley, and sumpweed were cultivated. Gourd and maize had also been adopted, but stable carbon isotope assays on human bone from these sites indicate that consumption of maize was limited.

Midden deposits and activity profiles reconstructed on the basis of artifact assemblages indicate year round settlement at both sites. Nearly all of the chipped stone artifacts and debris found at these sites appear to represent locally derived cherts and quartzite. Thus, participation in external trade/exchange networks involving exotic stone materials is not indicated. There is no direct evidence that Emergent Mississippian populations in the eastern Ozarks constructed local mound centers, although the Pigman Mound site along in the Eleven Point River drainage may be one such center.

Ceramics from the Gooseneck and Owls Bend sites are primarily shell tempered. However, there are some interesting differences in other ceramic attributes observed in the assemblages from these sites. At Gooseneck, most of the undecorated shell tempered pottery represents the type Neeley's Ferry Plain, but a small amount of red slipped pottery identified as Varney Red Filmed occurs as well as a slightly larger amount of reddish brown slipped pottery. Vessels forms are mainly jars with outflaring rims. Lynott attributes this

pottery assemblage to the Naylor Phase of the Emergent Mississippian Varney Tradition. In contrast, the shell tempered pottery from Owls Bend exhibits mainly plain surfaces. Most of the vessels represent small to medium jars which have flat bottoms, vertical walls, and slightly inverted or slightly everted rims. A few vessels exhibit check stamped, simple stamped, and incised line decorations. The ceramic assemblage from the Dirst site appears more similar to that of the Owls Bend site than that of the Gooseneck site.

This Emergent Mississippian adaptation in the eastern Ozarks endured until approximately A.D. 1200, at which point these populations evidently merged with groups inhabiting the central Mississippi Valley.

In seeking an explanation for the development of this adaptation in the eastern Ozark region, Lynott points to the region's diverse topography and the variable ecological setting of sites representing the Emergent Mississippian manifestation. Thus local ecological circumstances are identified as playing an important role in the widespread cultural variation observed during the Woodland to Mississippian transition. In time, however, Lynott suggests closer relationships developed with Emergent Mississippian people in the central Mississippi Valley, referring in particular to evidence from the Zebree site excavated by Dan and Phyllis Morse (Morse and Morse 1980). At Zebree, a premaize, hunting-gathering-domestic plant production economy is represented in association with seasonally dispersed household communities inhabiting small tributary watersheds.

Central Mississippi Valley

The central Mississippi Valley, defined as the stretch of the Mississippi alluvial valley between the Ohio and Arkansas Rivers (Morse and Morse 1983), is the heartland of classic Mississippian culture. The development of Emergent Mississippian in this region is best documented at the Zebree site in northeast Arkansas. Excavations here produced evidence of a Late Woodland or Baytown period (ca. A.D. 400-700) occupation followed by an early Mississippi period (ca. A.D. 800-1,000) occupation (Morse and Morse 1980, 1983, n.d.). During the Baytown period, the Zebree site was occupied during the fall and winter by a group consisting of probably several households. In the course of this occupation a large amount of sand tempered pottery was broken. The Morses believe this site represents one component of a semi-sedentary settlement pattern in which groups followed an annual cycle of alternating population dispersal and aggregation keyed to geographical and seasonal variations in the distribution and availability of local subsistence resources.

In contrast, the Mississippian component at Zebree represents a permanent village inhabited by as many as 120-130 people. This village compound contained midden deposits and postmold patterns demarcating rectangular houses with associated storage pits. Burials were also found in the midden, near the houses. No grave goods were associated with the burials. However, there may have been some ranking among the families occupying the site, as indicated by one household area in which a higher concentration of deer bone was found in its midden than was generally the case at the site. Trace element analysis of skeletal remains indicated that most of the site's inhabitants did not consume large amounts of red meat.

Artifacts associated with the Mississippian component at Zebree included arrowpoints (primarily serrated Scallorn or Sequoyah points), and shell tempered pottery mainly representing the types Varney Red Filmed, Mississippi (Neeley's Ferry) Plain, and Wickliffe Thick. Vessel forms included globular jars with strongly recurved and outflaring rims, salt pans, bowls, and hooded bottles. A microlithic industry was also identified, similar in form and content to the Cahokia microlithic industry, that probably was used in the manufacture of shell beads. Subsistence remains indicate a mixed economy based on hunting, gathering, and the cultivation of domesticated indigenous plants. No evidence of maize production was found at Zebree.

The Woodland to Mississippian transition in the central Mississippian Valley was one that ultimately produced some of the most complex agricultural societies ever to develop in eastern North America. At Zebree, the initial stages of this dramatic cultural transformation involved a shift from semi-sedentary to sedentary settlement that seems to be associated with the advent of domesticated plant production and the aggregation of larger groups of people at permanent village sites. In seeking an explanation for this phenomenon, the Morses point out that while no particular external environmental changes occurred at this time, several other factors can be identified that led to a significant restructuring of the human ecosystem during the Mississippian era.

To begin with, an increased dependency on domesticated plant foods, especially the maize-beans-squash complex, stimulated a shift of permanent settlement locations to areas where productive soils were most extensively distributed. With increasingly sedentary settlement and a subsistence economy based primarily on maize agriculture, population sizes began to increase. In this context, the need for sedentary groups to obtain nonlocal raw materials would have required the development of specialized acquisition and distribution strategies. Stone resources for the production of a variety of tools, including hoes and heavy woodworking implements, were especially critical resources that central Mississippi Valley inhabitants had to import. Trade/exchange networks among adjacent local groups, which already were in place by this time, evidently were adapted for the purpose of distributing exotic raw materials throughout the region. As agricultural subsistence economies developed, these same networks were probably also employed for redistributing food resources to even out local variations in production. Consequently, local groups became increasingly dependent upon each other. Moreover, the need to manage and coordinate these redistributive systems of exchange provided a context for the emergence of the chiefly level of social organization that is the hallmark of classic Mississippian culture.

To generalize from the Morses interpretations, it appears that the emergence of Mississippian adaptations in the central Mississippi Valley involved a narrowing of the ecological niche occupied by local sedentary groups upon their adoption to maize agriculture. To even out local variations in maize production, and to facilitate acquisition of nonlocal raw materials, these local groups became mutually dependent upon regional redistributive networks, the control and manipulation of which gave rise to the chiefly forms of social organization characteristic of Mississippian culture.

Central Arkansas River Valley

An important Emergent Mississippian development in another region adjacent to the central Ozarks is represented by Plum Bayou culture in the central Arkansas River Valley (Rolingson 1982). At the Toltec site near Scott, Arkansas, extraordinary earthworks construction was underway by 1,250 B.P. Here Plum Bayou people built three large mounds and at least fourteen smaller mounds, and a surrounding embankment enclosing an area some 40 ha in extent. The arrangement of mounds within this enclosure enabled the builders to keep track of changing solar alignments, and the mounds themselves were positioned according to standard distance measures (Sherrod and Rolingson 1987).

Excavations at Toltec have produced evidence of year round occupation, although it does not appear that the site was inhabited by a large residential population. The domestic activities of what might have been a caretaker population produced an artifact assemblage dominated by ceramics and lithics. The pottery types most frequently represented are clay tempered wares including Baytown Plain, Larto Red Filmed, and local varieties of Coles Creek Incised. Several other decorated types have also been identified, some of which may have been used in ceremonial rather than in domestic contexts. Stone artifacts were made from locally available gravel cherts, and novaculate and other types of stone transported from the Ouachita Mountains. Quartz crystal was also used, both in whole crystal form and as a raw material for the production of flaked tools.

Subsistence remains from Toltec indicate that hunting, fishing, and gathering were important seasonal activities. Deer, turkey, turtles, and fish were the major sources of meat and other byproducts. Certain species of birds, including redheaded and pileated woodpeckers, were perhaps sought for their brilliantly colored feathers which may have been used in ritual contexts. Nuts and other wild plant foods were also collected. Indigenous seed bearing plants may have been cultivated, but there is little evidence for the production of maize or other tropical cultigens.

Rolingson interprets the Toltec site as the premier civic and religious center of Plum Bayou culture. The site is furthermore identified as one of a handful of "megasites" representing the development of complex, hierarchically organized societies in the lower Mississippi Valley. Despite this connection with cultures further to the South, Plum Bayou culture clearly appears to be an in situ development, possessing a distinctive central Arkansas River Valley identity.

The Plum Bayou settlement pattern is not well known, but recent excavations at two additional sites provides some useful information. At the Ink Bayou site, located near Little Rock, a single house with associated food storage pits was found. A small midden deposit was associated with this house (Sabo et al. 1988:78). At the Alexander site, located about 100 km further up the Arkansas River from Toltec, another midden deposit was found in which four components were identified representing occupations from Middle Woodland through Mississippian times. One of two Late Woodland components at this site was attributed to the Plum Bayou culture (Hemmings and House 1985). Several post molds, refuse pits, and an earth oven were attribut-

ed to the Plum Bayou component, as was a small cemetery area with six interments but no accompanying grave goods. Subsistence remains indicated that the Plum Bayou culture inhabitants of this site were mainly dependent upon hunting and gathering, although evidence for limited plant cultivation was found. Deer, small mammals, turkey, fish and turtle were taken in the chase. Nuts and a variety of seeds were collected, including maygrass, knotweed, and goosefoot. Squash, gourd, and domesticated sumpweed were cultivated, and a single cupule of maize was also identified.

In summary, Plum Bayou habitation sites reflect a fairly common adaptive organization for this time period, based on sedentary settlement and a broad spectrum subsistence economy. Hunting and gathering were evidently the most important subsistence activities, but domesticated plant production had been adopted although an extensive dependency on maize had not been developed. Even though this adaptive organization is very similar to contemporaneous developments in adjacent regions, Plum Bayou culture possessed a unique element in the construction and use of the Toltec site for civic and ceremonial purposes that unquestionably had no counterpart in adjacent localities.

Western Ozark/ Arkansas River Valley Area

The final area from which comparative information will be drawn is the western Ozarks and adjacent Arkansas River Valley in northeast Oklahoma, northwest Arkansas, and southwest Missouri. Late Woodland and Early Mississippian cultural development in the area provided the setting for the subsequent emergence of the Spiro site as a premier midsouth civic-ceremonial center.

Late Woodland populations were unevenly distributed throughout the western Ozarks. Sites in southwest Missouri on which grit and limestone tempered pottery is found are relatively infrequent. In northwest Arkansas and northeast Oklahoma, sites dating to the Late Woodland period occur in larger numbers and provide evidence of a semi-sedentary adaptation based on hunting, gathering, and the cultivation of indigenous seed bearing plants (Brown 1984b; Fritz 1986; Sabo et al. 1988). A few sites, such as the Vanderpool site in northeast Oklahoma, mark the emergence of sedentary settlement, as evidenced by postmold patterns indicating the construction of houses, refuse pits, midden deposits, and burials (Harden and Robinson 1975). Another feature of the Middle and Late Woodland period in the western Ozarks is the development of shell tempered pottery, represented most commonly by the type Woodward Plain.

In the Arkansas River Valley of western Arkansas, a Late Woodland manifestation known as the Gober complex has been identified by Hoffman and his associates (Hoffman et al. 1977). This complex is related to the contemporaneous Fourche Maline cultures further to the south in the Ouachita Mountains and Red River Valley regions. Diagnostic artifacts include contracting stem Gary points, siltstone spades, and grog tempered Williams Plain pottery. At the Spinach Patch site, evidence of a planned layout is seen in the placement of two mounds, a central plaza, and a residential area consisting of a midden deposit containing daub fragments that may represent the use of clay plastered houses.

Further up the Arkansas River Valley in eastern Oklahoma, important events transpired which gave rise to the development of the so-called Arkansas River Valley Caddoan cultures of the Mississippi period. The most noteworthy evidence of this development occurs at a series of mound sites distributed along the Arkansas River and its major tributaries, including the Canadian, Poteau, Grand, and Illinois rivers.

The Spiro site, situated along the Arkansas River, was occupied by a Late Woodland Fourche Maline population, but the nature of that occupation is unclear. During the subsequent Evans phase (1,250-1,000 B.P.), however, mound building activities commenced and, additionally, new types of pottery were adopted, some of which was placed in burials. These new pottery types include varieties of Coles Creek Incised, French Fork Incised, LeFlore Plain (a grit tempered ware), and Williams Plain. The occurrence of these pottery types at Spiro and other related mound sites, such as the Brackett and the Eufaula mound sites, indicates interaction with the Plum Bayou culture further downstream. It is perhaps significant in this regard that a similar development of mound centers and burial ceremonialism is also observed at the time in the Red River Valley, which Schambach (1982) believes is also related to the construction of Toltec and the development of Plum Bayou culture. Brown (1984b) interprets the events at Spiro and other local centers as a reflection of a widespread pattern of social change influencing many local, indigenous cultural traditions.

Only a few residential sites dating to the Evans phase are known. These sites indicate that a sedentary adaptation had developed based on hunting, gathering, and limited domesticated plant production. The emergence of burial ceremonialism during the Evans phase established a pattern that would become an enduring and distinguishing feature of the Arkansas River Valley Caddoan tradition.

Developments during the subsequent Harlan phase (ca. 1,000-700 B.P.) are marked by the emergence of the Harlan and Spiro sites as paramount civic-ceremonial centers (Bell 1984b). At both sites, evidence of increasingly elaborate burial ceremonialism is found. At Harlan, for example, a multi-stage burial program for elites has been identified, in which decedents were placed first in mortuary structures, or charnal houses, that had been erected on top of platform mounds. These remains and accompanying funerary offerings were then removed, prior to the destruction of the charnal houses by fire. The skeletal remains were then bundled and interred in an accretional burial mound. Meanwhile, a new platform surface was constructed over the remains of the burned charnal house, and a new mortuary structure was then erected (Bell 1972). Evidence for this same burial program has been noted at other sites in the western Ozarks, such as the Goforth-Saindon site in northwest Arkansas (Kay, Sabo and Merletti 1989).

Harlan phase settlement patterns show an increased tendency for locational associations with fertile alluvial soils (Wyckoff 1980). Residential sites typically are small (2-4 ha), although some sites, like the Harlan phase village at Spiro, were considerably larger (8-10 ha). The presence of postmold patterns indicating substantial dwellings at these sites, and accompanying midden deposits, indicate a sedentary settlement adaptation (Brown et al. 1978). The correspondence of Harlan phase residential sites with alluvial soil associations has been taken by many archeologists as an indication of increasing dependence on plant cultivation, including

maize. However, only sparse evidence of domestic plant production has been found at these sites. Significant changes in social organization are more clearly indicated. Differences in the kinds of grave goods accompanying burials at residential sites as well as at mound centers demonstrate that a ranked social organization had emerged, in which members of certain lineages probably laid claim to important religious and political offices (Rogers 1983). Corresponding with the emergence of the ranked society during the Harlan and subsequent Spiro phases is the increased importance of trade networks bringing exotic raw materials and other goods into the Spiro locality (Brown 1983). The development of a network of mound centers across the western Ozarks that probably were satellite centers affiliated with Spiro may have been associated with the transportation of trade goods into and out of the Spiro locality (Sabo et al. 1988; Kay, Sabo and Merletti 1989).

Comparison

The preceding review of Emergent Mississippian developments in several subregions of the midsouth suggests that the development of a Late Holocene sedentary adaptation type was, on the one hand, a multilineal process that gave rise to distinctive regional variations. On the other hand, there was evidently sufficient contact and interaction across these subregions, perhaps emanating from such "megasites" as Cahokia, Toltec and Spiro, that it is possible to regard these distinctive regional developments as variations on a single broad cultural theme. The key elements of this theme are sedentary settlement, a subsistence economy in which the cultivation of domesticated plants had been added to hunting and gathering, population growth and a concomitant increase in local population aggregations, new technological developments including the advent of shell tempered pottery and the bow and arrow, the emergence of social ranking, the advent of burial ceremonialism as one indication of elite social status, and finally, the development of trade/exchange networks for the movement of exotic raw materials and other goods throughout the region.

Sedentary settlement patterns were in place in all five of the subregions reviewed here by Late Woodland times. The development of sedentism seems to correspond with the intensive utilization of nuts and seeds and the addition of plant cultivation to the subsistence economy. At this time, however, the production of maize was unimportant or nonexistent throughout the midsouth.

The best evidence for an increase in overall population size comes from the central Mississippi Valley, where it is also clear that local population aggregates were also beginning to occur at major sites such as Zebree. Population increases have also been inferred in the western Arkansas Valley Caddoan area, where a few large village sites have been identified but where dispersed small groups were probably more characteristic. Major population increases probably did not occur in the eastern and central Ozark subregions, where dispersed populations also continued. Whether overall population sizes increased in the central Arkansas River Valley is presently unclear, but local groups evidently remained dispersed even after the construction of the Toltec site.

Technological developments that are the hallmarks of the Mississippi period are noted throughout the subregions compared here, although some developments took hold in different places at different times. The bow and arrow was adopted in all of the subregions during the Woodland era. Shell tempered pottery was evidently developed first in the Ozarks, during Middle and Late Woodland times, spreading at a somewhat later date into the central Mississippi Valley and the central Arkansas Valley. In the central Mississippi Valley, a specialized microlith industry was identified at the Zebree site that is similar to the one found at Cahokia.

The emergence of social ranking in the midsouth has been inferred on the basis of differences in grave goods accompanying burials, differences in faunal remains and other articles of material culture associated with individual household complexes at residential sites, and from the development of regional mound centers and settlement hierarchies. Consequently, social ranking has been attributed to Emergent Mississippian societies in the central Mississippi Valley, the central Arkansas Valley, and the western Ozark/Arkansas Valley Caddoan areas. There is, at present, no evidence for the development of pronounced social ranking at this time period in the eastern Ozarks, nor has such evidence been encountered throughout most of the central Ozarks. However, in the middle portion of the White River Valley in southcentral Missouri and northcentral Arkansas, the occurrence of Southern Ceremonial Complex artifacts and burials with high status grave goods points to the emergence of social ranking in that area (Sabo et al. 1988). Unfortunately, poor chronological control of the archeological contexts of these finds prevents us from determining precisely when social ranking developed in this region.

Burial ceremonialism as one indication of elite social status is most pronounced in the western Arkansas Valley Caddoan area. The beginning of the practice is associated with Evans phase interments at Spiro. This practice was elaborated at a number of sites during the Harlan phase, and it culminated around 1350 A.D. in the Spiro phase "Great Mortuary" at the Spiro site. In a cavity within the Craig mound at Spiro, a number of burials--some on cedar pole litters, others extended on the floor of the cavity, and still others consisting of disarticulated remains in basketry chests--were interred with a spectacular assemblage of funerary offerings including decorated marine shell cups and gorgets, fabric robes, carved stone figurines, pottery vessels, and thousands upon thousands of shell and pearl beads (Phillips and Brown 1978).

Even though the archeological data from the five subregions treated here are uneven and thus problematic for comparative assessments, there clearly is considerable support for the contention made earlier that Emergent Mississippian developments throughout the midsouth generally reflect local variations on a broader cultural theme. Whether all of these variations indeed reflect the development of Mississippian culture per se (Smith 1978), is an important question that needs to be resolved. However, to the extent that historical and cultural continuities can be identified across the five subregions considered here, some important conclusions may be drawn. First, there do not seem to be any specific external environmental factors, such as climatic changes or other such phenomena, that can be identified as bringing about the multiple cultural changes that mark the Woodland to Mississippian transition. However, the shift from mobile to semi-sedentary and sedentary settlement, and the intensification of plant utilization--including the domestication of some plant

species--led to restructuring of local human ecosystems throughout the midsouth that had significant consequences for subsequent cultural developments.

Two ecological consequences of the shift to sedentary settlement and the cultivation of plant foods seem to be most noteworthy. The first is that for most groups, sedentism brought about a reduction in the width or breadth of their niche within the local ecosystem, even though the utilization of multiple subsistence resources continued in most areas. Secondly, the environment potential of local ecosystems to support an intensification of domesticated plant production became an increasingly important limiting factor. Attempts to respond to these constraints through population redistribution strategies, trade/exchange networks, and associated redistributive systems account for some of the variations observed in cultural developments in the midsouth during the Mississippi period, particularly with respect to the degree of population growth and integrative complexity achieved in some areas.

Other aspects of cultural development and variation, however, cannot be so easily traced to local ecological circumstances. The degree to which burial ceremonialism was adopted as an indicator of elite social status, and the nature of ceremonialism associated with mound centers, both appear to be the products of sociocultural differences varying independently across local human ecosystems.

In conclusion, it is suggested here that cultural developments in the midsouth during the Woodland to Mississippian transition were the result of multilineal processes influenced mainly by local ecological circumstances and independent sociocultural factors. These processes gave rise to regionally distinctive variations on a larger Mississippian cultural theme. A significant factor accounting for cultural similarities across the midsouth may have been the widely extending influences of such "megasites" as Cahokia, Toltec, and Spiro. The most important conclusion offered as a result of the foregoing comparative assessment, however, is that late prehistoric populations inhabiting the central Ozark subregion were active participants in these processes. Consequently, and in contrast to earlier assessments (e.g., Willey and Phillips 1958), these Ozark populations also were influenced by the broader patterns of Emergent Mississippian cultural development.

CHAPTER 14

Summary, Conclusions, and Recommendations

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Project Summary and Conclusions

Archeological investigations by the Arkansas Archeological Survey at 3MR80-Area D in the fall of 1988 consisted of a coordinated program of mapping, shovel testing and column sample excavation, backhoe trenching, and excavation of seventeen 2x2 m test units. Geomorphological studies were also undertaken to permit the interpretation of archeological data concerning prehistoric occupations at the Dirst site within the context of the changing alluvial landscape of the lower Buffalo River locality. Specialized studies concentrated on lithic and ceramic artifacts, faunal remains, floral remains, radiocarbon dating, sedimentary analysis, computerized analysis of environmental parameters in the Rush locality (including reconstruction of the presettlement forest using nineteenth century Government Land Office survey records), and computerized analysis of prehistoric land use in the Rush locality.

As a result of these investigations, several prehistoric components were identified and cultural reconstructions were provided for each. The earliest component probably represents a series of temporary occupations during the Dalton and Early Archaic periods. An Early Archaic to Middle Archaic component was tentatively identified, but few materials representing this component were collected, mainly because the associated stratum was below the reach of most of our controlled excavation units. A Late Archaic component was identified that probably represents a seasonal occupation. Lithic artifacts and debris associated with this component permitted a reconstruction of Late Archaic stoneworking technology. An Early Woodland component--the first ever to be stratigraphically isolated at an open site in the Ozarks--is represented by a small assemblage of diagnostic projectile points and grog tempered pottery found in a organically enriched midden sediment. If correctly identified, this is the earliest documentation of the use of pottery in the Ozarks. An arc of postmolds and preserved plant remains including knotweed, bedstraw, chenopodium, and amaranth, in addition to the midden development and pottery, indicates an Early Woodland period development of the Late Holocene Semi-sedentary adaptation type in the central Ozarks. Finally, a Middle Woodland to Early Mississippian occupation identified in the thick, rich midden deposit at 3MR80-Area D was represented by abundant cultural remains that included a predominately shell tempered ceramic assemblage and evidence for the cultivation of a

variety of domesticated plant species including little barley, maygrass, chenopodium, sunflower, squash/gourd, and maize. Although maize was a minor constituent of this cultigen assemblage, the overall impression gained from the combined evidence representing this component is that a transition from the Late Holocene semi-sedentary to the sedentary adaptation type may have been underway in the central Ozarks by Middle Woodland times. A noteworthy and regionally distinctive aspect of these Late Holocene adaptation types is the maintenance of a broad-spectrum subsistence economy, in which hunting--particularly of deer and elk--remained very important.

Intrasite analysis of the evidence associated with the multiple components at 3MR80-Area D centered on five phenomena: 1) changes in the use of the Dirst site as a settlement type within successive prehistoric settlement patterns; 2) changes in preferences affecting the use of raw material sources for stone tool production; 3) changes in the importance of raw material types brought in or sent out from the Dirst site, and implications concerning the organization of prehistoric communities in the Rush locality and interaction with more distant communities; 4) the evolution of pottery making technology; and 5) development of subsistence adaptations incorporating domesticated plant foods. The insights provided concerning each of these topics represent important contributions to our present understanding of prehistoric cultural development in the central Ozarks.

A GIS-based, computerized analysis of prehistoric land use in the Rush locality provided additional insights concerning the prehistoric adaptations in the central Ozarks. The analysis of distances to various bedrock sources from the Dirst site helps to explain the relative proportions of chert types represented in the lithic assemblages of the various components. Particularly noteworthy are the results of the catchment analysis based on travel cost which shows that the Dirst site inhabitants probably selected that particular location for occupation because of the access it provided to a variety of upland and bottomland environmental zones/resources, rather than for any particular resource that lay close at hand. This finding is consistent with the conclusions reached concerning the maintenance of a broad-spectrum subsistence economy, and provides considerable insight concerning the strategies by which Late Holocene populations were able to combine sedentary settlement with a mixed subsistence economy strongly dependent upon seasonably available natural resources.

Lastly, a comparison of the Woodland to Mississippian transition at the Dirst site with Emergent Mississippian developments in several adjacent areas (eastern Ozarks, central Mississippi Valley, central Arkansas River Valley, western Ozarks/Arkansas River Valley Caddoan area) revealed that the prehistoric inhabitants of the central Ozarks participated in the same broad pattern of cultural development that their neighbors in surrounding regions participated in. As a result, central Ozark populations were influenced by the same ecological and sociocultural processes that gave rise to variants of Mississippian culture throughout eastern North America. This perspective stands in dramatic contrast to earlier interpretations (e.g. Willey and Phillips 1958) that portray the Ozarks as a moribund backwater unaffected by formative cultural developments in eastern North America.

Conclusions

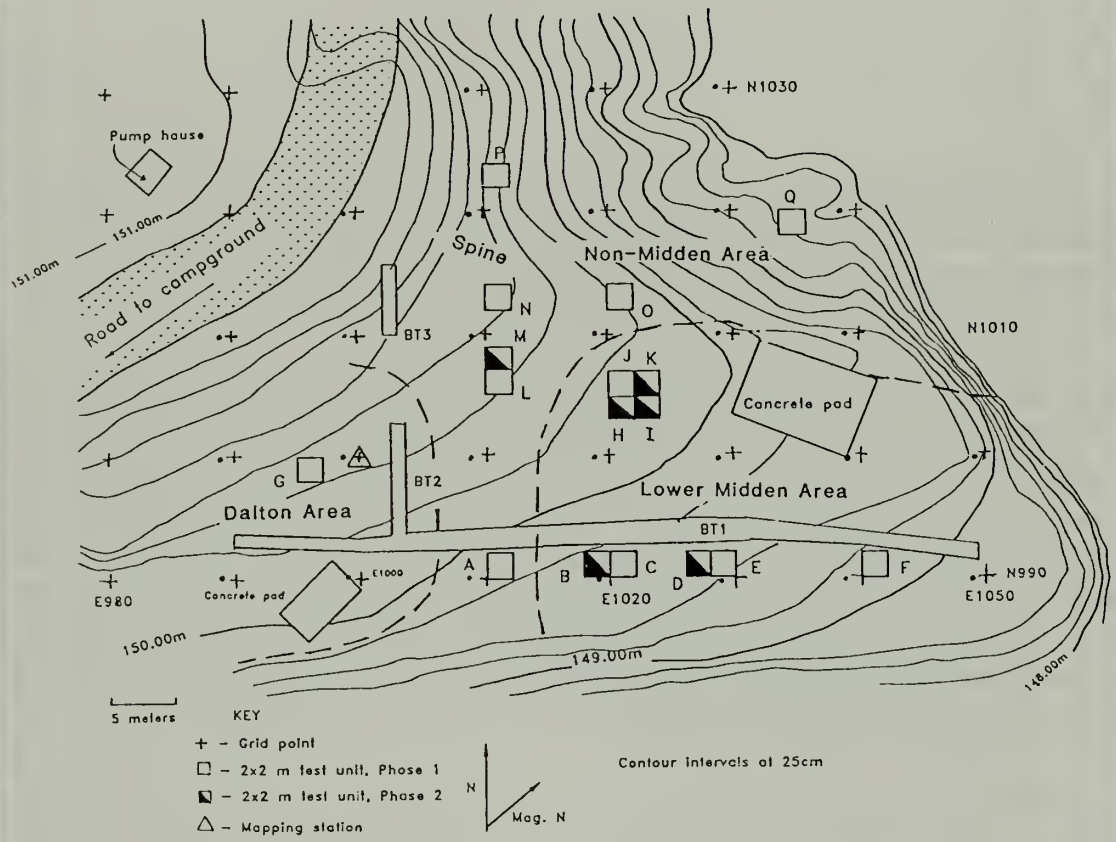
The preceding summary of the Rush project and its results establishes the considerable scientific importance of the Dirst site and related archeological sites in the Rush Development Area. This importance is manifested in two ways. First, a portion of 3MR80-Area D, as well as other parts of 3MR80, still contain intact, buried archeological deposits that we now know are of previously unmatched integrity and quality. It is furthermore likely that other presently known sites in the Rush Development Area, particularly those examined by SPEARS in 1986, contain archeological deposits possessing equivalently high integrity and quality. Further work at these sites could provide extensive and impressively well preserved data on prehistoric lifeways and adaptations to past Ozark environments. The multicomponent character of the Dirst site, which contains evidence representing nearly the entire spectrum of prehistoric cultures in the central Ozarks, is extremely significant in its potential for both intrasite and intersite comparisons.

The second aspect of the importance these sites possess is that the research potential of the curated and documented collections resulting from the 1986 investigations by SPEARS and our own work in 1988 is by no means exhausted. A wide range of additional specialized analyses could be undertaken using these collections which would provide considerable new information concerning prehistoric lifeways and adaptations in the Ozark region. Indeed, the results of our preliminary studies have only begun to realize the full interpretive potential of the data for clarifying many issues concerning Ozark prehistory, but even so the conclusions we have reached so far have surpassed the initial goals identified in the original research design. The significance of the Dirst site and the cultural record it contains will no doubt increase as future survey and excavations in the Buffalo National River continue to build upon a growing corpus of comparative information.

On the basis of the preceding conclusions concerning the significance of the Dirst site and other sites in the locality, we offer the following recommendations for cultural resource management in the Rush Development Area. These recommendations are divided into two groups: 1) recommendations for on-site management and protection of known significant resource areas in the Rush Development Area; and 2) recommendations for further research on 3MR80-Area D.

Recommendations for On-Site Management and Protection

The excavation of seventeen 2x2 m test units and three backhoe trenches in 3MR80-Area D has shown that significant near-surface deposits east of the campground road exist in two areas south of the elevated "spine" that forms the apex of this landform. These two areas are the projected "Dalton area" and the "lower midden area" shown on Figure 14-1. These two near-surface deposits contain highly significant evidence of prehistoric occupation that would be threatened by any use or development of this area as a campground. Indeed, the proximity of these deposits to the present ground surface makes them susceptible to damage resulting from vandalism as well as from natural processes such as erosion and bioturbation.



A = N990/E1010
B = N990/E1018
C = N990/E1020
D = N990/E1026
E = N990 =E1028
F = N990 =E1040
G = N998/E995
H = N1003/E1020
I = N1003/E1022
J = N1005/E1020
K = N1005/E1022
L = 1005/E1010
M = N1007/E1010
N = N1012/E1010
O = N1012/E1020
P = N1022/E1010
Q = N1018/E1034

Figure 14-1. Map of 3MR80-Area D, showing archeological excavations, nonmidden area, lower midden area, and Dalton area.

Our investigations in Area D furthermore were divided into two phases: 1) an exploratory first phase designed to delimit the extent of significant cultural deposits, and 2) a second phase of excavation to extract archeological remains from significant contexts as a form of mitigation of adverse impacts. Only this second phase, representing about 50 percent of the effort expended during the field program, was therefore specifically directed toward the recovery of significant data for the purpose of mitigating adverse impacts. In view of the unprecedented quality and integrity of the deposits in the projected Dalton and lower midden areas, it is our opinion that the excavations in these areas do not constitute adequate mitigation of adverse impacts that can be anticipated from the proposed construction and use plans for Area D. Therefore, we recommend that these two portions of Area D--the projected Dalton and lower midden areas--be protected. If these two portions of Area D cannot be protected, then additional data recovery excavations are recommended below. Development and use of other portions of Area D east of the campground road, especially the nonmidden area to the north of the central "spine," would adversely impact no significant archeological deposits.

Although current plans do not call for development of the portion of Area D that extends west of the campground road, the presence of the "upper midden" discovered in that area must be noted. This deposit is also a highly significant cultural resource, and it remains threatened by the potential for vandalism and natural degradation even if no development and use takes place in that area.

The delineation of discrete cultural components represented in the archeological record of 3MR80-Area D provides a framework for comparative analysis and interpretation of archeological remains previously identified in Areas A and C of 3MR80, and at 3MR51, 3MR52, and 3MR157 (Sierzchula 1984; Spears et al. 1986). These additional locations of significant archeological remains in the Rush Development Area should therefore be protected to the fullest extent possible.

While it is relatively easy to address in detail the resource at Area D, given the forgoing work, our knowledge of other areas of 3MR80, and 3MR51, 3MR52, and 3MR157 is not comparable. The previous professional investigations of Sierzchula (1984), Spears et al. (1986), and Sabo et al. (this report) have documented 8,000 years of human occupation in four prehistoric sites and one historic site within the Rush Development Area. Most of the prehistoric sites appear to be multicomponent and though four sites have been identified, the discontinuous distribution of deposits in both vertical and horizontal dimensions strongly suggests the boundaries of the deposits may be somewhat arbitrary. The subsurface stratigraphy is further confused by various episodes of river deposition and scouring.

It is fiscally impossible to excavate or to preserve all of the cultural resources within the Rush Development Area. However, it is clear that the Rush area will continue to be utilized by the public even if planned enhancements are not completed, accompanied by a corresponding degradation of the cultural resources there. Site management must therefore concentrate on how to minimize and control the adverse impacts and how to protect the most sensitive aspects of the cultural resources overall.

This goal can most effectively be reached through creation of a long term management plan for the cultural resources preserved at the Rush locality. The plan must incorporate the following elements:

1) The location, description, and assessment of all known cultural resources in their horizontal and vertical extent.

2) Identification of which cultural resources are most critical in significance and most susceptible to impacts, and identification of locations where additional testing may be needed before future developments will be permitted.

3) Identification of areas at Rush that have been disturbed (such as 3MR51-Feature 1 area), where no deposits exist (MR80-Area B), or where the depth of deposits indicate the least likelihood of disturbance.

4) Specific instructions to govern the use or development of each cultural resource area. The latter would be a logical management synthesis of the first three elements of the plan.

These instructions may also address how to provide for the planning and clearance of individual construction projects in an area as archeologically complex as the Rush Development Area.

Any further monies spent to mitigate adverse impacts of construction or continued use of the Development Area would thereby contribute to the overall update of the plan, while also providing enhanced management capability applied to the remaining resources. Further assessment of the geomorphology of the Rush Development Area to clarify our understanding of the potential that specific landforms and depositional units have for containing significant prehistoric and historic cultural remains would be advisable.

Recommendations for Further Research, Area D

The analyses and interpretations provided in this report adequately address fundamental issues for Area D concerning cultural affiliations, site structure, site context, site condition, and significance. One shortcoming of the present study, however, is the lack of an intrasite spatial analysis to delineate activity areas for the various occupation zones identified in Area D. The deficiency is the result of inadequate spatial sampling: only nine 2x2 m units were excavated in the lower midden area, and only one unit was excavated in the Dalton area. Further excavations in Area D should attempt to expand the area coverage sufficiently to permit intrasite spatial analysis. Additionally, full exposure of the possible house feature is Stratum 5 and the postmold pattern in Stratum 4 should be attempted.

We therefore recommend that a second phase of mitigation excavations be conducted at 3MR80-Area D to concentrate on collecting additional data from the Dalton and lower midden areas. Excavation and additional analysis should be guided by the research design presented in Chapter Two of this report.

Excavations in the Dalton area should focus on Stratum 1b, the Dalton to Early Archaic component in the area of N990/E995. The deposits in this location are within 50 cm of the surface and are amenable to easy recovery. The goal of this would be to recover a large enough sample of stone tool categories and waste byproducts to permit reconstruction of manufacturing processes and tool utilization. Recovery of flotation samples will be of critical importance since preserved floral specimens were found in 1988. Owing to the apparently deflated nature of the deposit, we do not anticipate the presence of features. Charred plant material in sufficient quantities for carbon dating may or may not be preserved, but if not, a radiocarbon assay on soil humates could be obtained. A single block of four 2x2 m units excavated to the base of the artifact-bearing portion of Stratum 1b should provide a sufficient sample for analysis. The results that can be anticipated from this effort would provide an extremely important contribution to our understanding of the Late Pleistocene to Early Holocene prehistory of eastern North America.

The excavations in the lower midden area should concentrate on exposing the major structural features already defined in Strata 4 and 5. The Early Woodland component in Stratum 4 lies directly beneath the rock-strewn living floor of Stratum 5. These two strata are closest to the surface and are therefore susceptible to destruction. Since structural features in Strata 4 and 5 overlap, we recommend that 4x4 m block excavations be opened on both sides on Backhoe Trench 1 in the area where the suspected house features were identified. The data from Stratum 5 will provide, in addition to the structure itself, the widest assortment of tools, tool manufacturing byproducts, ceramics, and subsistence information. Although floral and faunal remains recovered from Stratum 4 are in a comparatively poor state of preservation, attention to careful flotation recovery in both strata is warranted.

Two blocks of four to six 2x2 m excavation units, one on the south side of Backhoe Trench 1 and one on the north, should completely expose both structures. These excavation units should additionally provide a sufficient supplementary sample of artifacts from both strata to permit intrasite analyses of data representing the Early Woodland and Middle to Late Woodland components.

In view of the assessment of the floral remains by Gayle Fritz, particular attention must be paid to recovery of flotation samples. The relatively low recovery rate for carbonized specimens is due in our opinion to mechanical recovery methods and not to the samples' state of preservation. To improve these methods, we recommend that flotation samples collected from additional excavation be treated with a deflocculant in the laboratory before they are submitted to the ethnobotanist. We also recommend that the heavy fraction flotation analysis samples from the 1988 excavation be retreated and submitted for analysis.

With the identification of fragmentary human remains in the Stratum 5 midden, future excavations should also be aware of the possibility of encountering burial features.

Finally, in view of the significance of the chronometric assessments of the components identified in Area D, efforts should be directed toward recovery of additional samples for radiocarbon or archeomagnetic dating. Direct radiocarbon dating of a sample of the maize previously recovered from Feature 4 is also recommended.

The recommendations presented here reflect our best assessment of the extraordinary archeological record preserved at 3MR80-Area D. The proposed second phase of excavations follows and builds previous research in Rush Development Area and the commitment of the NPS to the protection of cultural resources in the Buffalo National River.

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APPENDICES

AVAILABLE UPON REQUEST

I. Letter of Acceptance, Arkansas Archeological Survey Proposal, National Park Service Scope of Work.

II. Feature 1 Excavations at 3MR51, by Randall L. Guendling.

III. Human Skeletal Remains from 3MR80-Area D, by Barbara Burnett.

IV. Field Specimen Catalog.

V. DELOS Listing, Shovel Tests.

VI. DELOS Listing, Column Samples.

VII. DELOS Listing, Test Units.

VIII. DELOS Listing, Features.

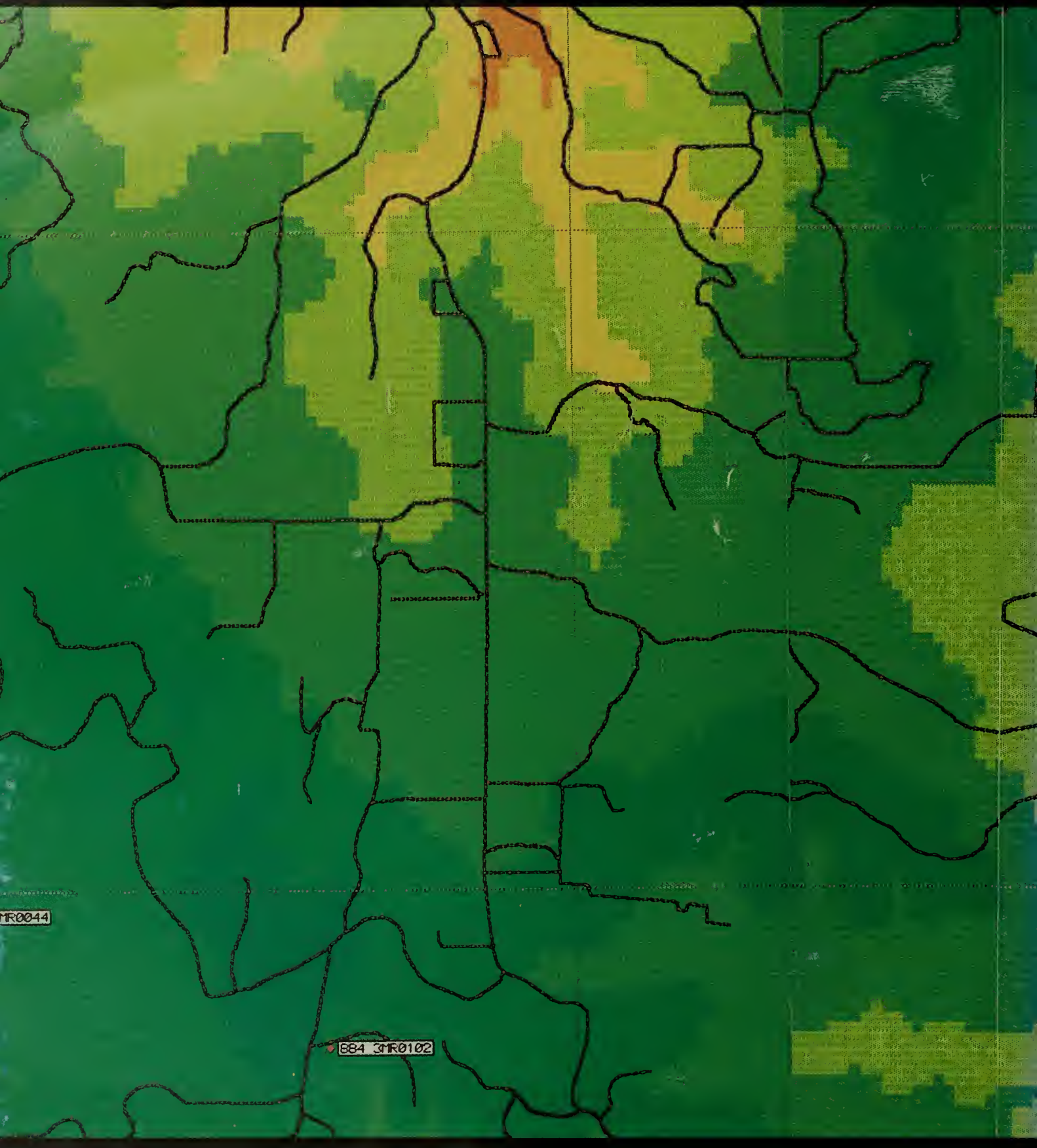
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